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REPORT

UPON THE

DEODAR FORESTS OF BUSSAHIR.

TO WHICH ARE APPENDED

REGISTERS OF VALUATION FOREST SURVEYS IN BUSSAHIR AND THE DISTRICT OF JAONSAR BAWUR, WITH OTHER STATEMENTS RELATING TO THE GROWTH OF THE DEODAR TREE IN THE WESTERN HIMALAYA.

BEING THE RESULT OF A JOINT EXAMINATION OF THE BUSSAHIR FOREST

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WITH A MAP, ILLUSTRATING THE SITUATION OF THE FORESTS.

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Introduction.—Having been directed to make, in company with Dr. Stewart, Officiating Conservator of Forests in the Punjab, a preliminary survey of the Deodar Forests, lately leased from the Rajah of Bussahir, with a view to sketch out the preliminary working plan to be adopted, I left Simla on the 8th September, and joined Dr. Stewart at Poinda on the 12th. Captain E. Wood, Officiating Conservator of the Oudh Forests, who had been associated with us in this work by the kind permission of the Chief Commissioner of Oudh, accompanied me. We found that Dr. Stewart had, previous to our arrival, made a tour along the right bank of the river from the 22nd August to the 11th September, and examined the Forests on that side as far as Lipi, which may be considered the limit of workable Deodar, though scattered trees of stunted growth are found as far as the Hangarang ridge. The results of his observations are incorporated in this Report, and in the papers attached. We left Poinda on the 13th September, and keeping the left or south side of the river, examined the Forests between Poinda and Sapni, which may be called the Lower Sutlej Forests on the left bank. On the 22nd September, we left Sapni, and proceeded to examine the Forests on both sides of the Buspa River. We followed the course of this tributary as far up as the village of Rakcham, above the limit of Deodar, and rejoined the Sutlej at Mebar village, where, on the 28th September, we commenced the examination of the upper Forests on the left bank of the Sutlej. On this side the last Forests are on the Reedong stream, a feeder, which joins the Sutlej from the east above the village of Rispa. On the 4th October we completed our work on the left side, and crossed the river about midway between Rispa and Riba, opposite the village of Akhpa, whence we followed the right bank, and after again crossing at Wangtu, reached Rampoor on the 13th October. From this place Dr. Stewart proceeded to Kullu, and I returned to Simla on the 18th October, examining on my way the Chaog Forest south of Fagu. Captain Wood preceded me a few days, as his presence was required at Lucknow. After a short stay at Simla, I proceeded to the depôt of Ropur on the Sutlej to see the timber collected there, and the mode of transport down the river; the result of my enquiries at this place is given in No. 80 of Appendix I.

2. *General Classification. Non available and available Forests.*—Before reviewing the results of our joint labours, I may explain that, as regards the prospective timber yield from these Forests, it is convenient to divide them into two classes, *viz.*, "available" and "not available."

The only method hitherto employed to transport timber from the Forests into the river, has been by rolling and sliding the logs down a dry ravine or a steep slope of the hill. The tracks thus smoothed by the passage of the logs are called slides. In a few instances these tracks have been improved by clearing away stones, brushwood, and other impediments.

Those Forests which are so situated, that logs cannot be transported to the Sutlej or its tributaries on slides similar to those hitherto used, or improved by blasting rocks or otherwise, must be regarded as not available at present for the supply of timber.

After a systematic working of the Forests has been established for a series of years, and the price of timber in the plains has risen, so as to justify a larger outlay on the transport, then the resources of the Forests, not now available, will come into play, either by converting the timber on the spot into scantling, which can be carried to the river, or by forming artificial slides and improving the tributaries so as to render them fit for floating timber.

These Forests are very extensive, and having only been worked to meet local requirements, they are rich in valuable timber. But as they will not be available for a series of years, it was not thought necessary to examine any except the Forests of the Kashong valley.

The second class would be composed of the Forests, from which, under the present system of working, the timber can be made available. The distinction is not absolute, as in many of the Forests called available, slides for the removal of timber must be opened out by blasting, but it is sufficiently definite for our present purpose.

3. *General review of the distribution of the Deodar Forests.*—The principal Deodar localities in Bussahir are near the Sutlej and its tributaries. A limited quantity is also found on the head waters of the Pabur stream, and its feeders, above Ruru village. Dr. Cleghorn mentions three tracts producing Deodar (Punjab Forest Report, page 5), 1st between Ruru and Chergaon behind the ruined fort of Batowli; 2nd on the Pej Stream; 3rd above Chergaon towards the Borenda Pass. There is also some Deodar on the tributaries which join the Pabur from the north. But according to the description of the river and the localities, given by Dr. Cleghorn, none of these Forests are immediately available for the export of timber.

On the Sutlej side of the water shed, the most important Forests are situated on the left bank of the main river and on the Buspa, commencing at Soongree near Poinda, and extending to the Teedong River. Below Soongree, there are a considerable number of isolated Deodar localities between the river and the line of watershed, but excepting near Taranda village, all are remote from the river, and the timber could only be made available by conversion into portable scantling. Thus there are Deodar Forests on the Choundeh Khad south-west of Taranda, on the south side of the Nogri stream, and on the head waters of the Bera River above Kotgurh. The last is called the Nagadar Forest, and judging from a number of logs and planks brought from this Forest for the construction of bridges near Nagkanda, the rate of growth appears to be remarkably rapid in this locality (See Appendix III, No. 1).

On the right side of the Sutlej, the highest Deodar Forests are on the south bank of the river Teti, opposite the village of Lipe. From this point, scattered Forests, generally poor, and often remote from the main river, extend down as far as the Rupigad, which joins the Sutlej from the north below Taranda.

We have thus five main geographical groups of the Deodar producing tracts in Bussahir. These must not be confused with the working divisions to be explained hereafter.

Names.	Number of first class trees supposed to be available.
I.—The Pabur Forests	None.
II.—The Lower Sutlej (below the mouth of the Buspa) on the left side	30,000
III.—The Buspa Forests	6,000
IV.—The Upper Sutlej Forests on the left side...	18,000
V.—The Sutlej Forests on the right side	4,000
Total	58,000

4. *General description of the Deodar Forests. Elevation.*—The bed of the Sutlej, four miles below the Wangtu bridge, where the more important Deodar Forests commence, is about 5,000 feet above the Sea, 33 miles higher up at the mouth of the Teti River near the upper limit of the Forests, its elevation is 7,600 feet. Near Nachar and Soongree, the lower limit of Deodar Forests commences at about 2,000 feet above the bed of the river; near Riba and Rispa only a few hundred feet intervene between the river and the first Cedars, and in the Buspa valley Deodar Forests fringe the banks of the river above the village of Shoang, and the last Deodar trees are found between the granite boulders of an old glacier Moraine below Rakcham village through which the river has forced its way.

Deodar Forests fit to be worked with advantage, rarely attain an elevation of 10,000 feet in Kunawur. Some of the most elevated Forests visited by us were the Phinla Forest, between Punung and Kilba, the Upper Buspa Forests, the Forests above Poari and the Simoling Forest between Purbani and Riba. The upper limit of these Forests was estimated by comparison with known heights at 10,000 feet. Dr. Thomson notes the highest Deodar in descending the Werang Pass on the east side at 11,000 feet, and scattered trees may, perhaps, be found at that elevation in other parts of Kunawur, but the more important Forests are confined to elevations between 7,000 feet and 10,000 feet.

5. *Aspect.*—It has been stated by several authors, that Deodar is found in greatest abundance on the northern slopes of the hills. This is, upon the whole, correct, and is remarkably exemplified in the hills of Kunawur. With rare exceptions, the slopes on which Deodar grows, are exposed to the north, east or west, a northerly and north-westerly aspect being most common. This is the reason why the hill slopes on the left bank of the Sutlej, Buspa and Teedong valleys, and on the right side of the Teti which face the north, north-west, and north-east are covered with the best Deodar Forests, the Forests being poor and scattered on the opposite sides.

6. *Rock and Soil.*—There is no great variety of rock in that part of the Sutlej valley to which this Report mainly refers. Granite, Gneiss and quartzose Schist are the principal rocks, and fine Deodar Forests with well shaped trees of large dimensions, are found on soils overlying each of these three formations. Limestone is not found to any great extent in this part of the valley, but we know from the examination of the Forests in the British district of Jaonsar Bawur, between the rivers Tonse and Jumna, and also in the valley of the Upper Chenab, by Cleghorn, that Deodar thrives well on limestone. In several Forests near Kilba village, the rock is a poor dry quartzose Schist. Here on steep slopes the trees are stunted, and there are other localities, where the influence of a poor soil on the growth of the tree is apparent.

7. *Gradient of the slope.*—A more or less steep gradient of the slope has a marked influence on the rate of growth and stature of the trees. We found small tracts covered with Deodar on rocky and almost precipitous slopes; in the majority of Forests the gradient is between 25° and 45°, and the prevalence of these steep slopes is a great draw-back to the Forests of Kunawur.

8. *Deodar Forests on deserted cultivation terraces.*—The most valuable Deodar localities are on the terraces of fields deserted centuries ago. These Forests sprang up after cultivation was abandoned, and the trees found ample nourishment in the comparatively level soil of these terraces, the ruined walls of which are still seen between the trees.

The Nachar Forest is the most remarkable instance of this kind. The circumstance was first observed by Dr. Aitchison, late Deputy Conservator of the Sutlej Forests. The largest trees here have attained a height of 250 feet and a girth of 20 feet. The largest trees are more than 550 years old, but the majority appear to be between 150 and 350 years. Possibly, the oldest trees may have existed before the fields were abandoned, which probably took place about 350 years ago. The Soongree Forest also stands on old cultivation terraces of about the same date as those of Nachar. The best part of the Janee, Phinla and Kiuden Forests is likewise on ground terraced by the hand of man. The same is the case in the Mebar Forests where however the majority of trees are smaller in size, and judging by the number of annual rings counted on the stumps of the larger trees, the Forest probably sprang up about 150 or 200 years ago. Some of the Purbani Forests also, and several other of the best Deodar localities in Kunawur, are found in similar places.

It is only in a few localities in the upper part of the Buspa valley above Sangla, in the Forests of Purbani, above Jangi, and in one or two other places, that Deodar is found on ground naturally level or with a gentle gradient, and these tracts are small.

9. *Largest trees measured in Kunawur.*—Round an old temple near the village of Kunai, between Kilba and Sapni, stand five splendid Deodars on a small plot of level ground, four of which have a girth of 25 feet 4 inches, 24 feet

0 inches, 23 feet 2 inches, and 17 feet 4 inches, and on one of the terraces above the village of Purbani an old tree was measured 34 feet 4 inches in girth and probably about 900 years old. A very large tree stands near Punang village; it was not measured.

The largest girths of Deodar in Kunawur on record are:—

36½ feet Taranda. (Madden).

36 feet Chasoo. (Madden).

35½ feet Soongree (Thomson, Hoffmeister and Cleghorn.)

10. *Average size and cubical contents of first class trees.*—The average size of first class trees is considerably smaller in the upper than in the lower portion of the Forests. This is particularly striking as regards the length of stems. The average height of first class trees below the mouth of the Buspa River may be said to vary from 100 to 150 feet; further up they rarely exceed 100 feet and are generally only 70 feet or 80 feet. In the Nachar Forest the average yield of the trees felled this season has been 6 logs of from 12 to 14 feet in length and measuring about 35 cubic feet each. In the upper Buspa Forest, the trees have only yielded from two to three logs on an average, and the same is the case in the Forests near Rispa and Lipi. In the Nachar Forest on 2·30 acres, 100 standing trees and 44 stumps of felled trees were measured, the result being an average contents of 218 cubic feet for first class, and 66 cubic feet for second class trees. Here, on an average, a length of 80 feet was available for timber.

In a portion of the Kiuden Forest, the average contents of 19 first and 11 second class trees was determined at 142 cubic feet for the first and 21 for the second class trees, a length of 60 feet being taken as available for timber. In the Nachar and Kiuden Forests, a number of felled trees was measured at different heights from the ground, the result is that the mean girth for logs, 80 and 60 feet long respectively, is about 8-10th of the butt girth. The details of these measurements, and of similar measurements taken in other Forest districts, are given in Appendix IV.

In most of the upper Sutlej Forests, a length of from 30 to 40 feet only would be available; at the same time the girth decreases more rapidly towards the top of the tree, and the girth at the base is not generally so large. The average butt girth in the upper Forests might be 8 feet, with a mean girth of 1 feet and a cubic contents of 40 feet. Upon the whole, we cannot expect that the average timber yield per. tree throughout the Kunawur Forests will exceed 75 cubic feet.

11. *Stature of the trees in the different Forest districts*—The stature of the trees is generally good, and the stems are straight. In Forests like Nachar, where the trees have grown up close together, the stems are clear of branches to a great height, and carry their girth well up. In Forests of an ordinary character, clear branchless stems with little decrease in girth are more common in the lower part of the valley.

In the Buspa Forests and along the Sutlej above the mouth of this tributary, a great change is perceptible, the trees even in Forests where they stand close together being covered with side branches to within a short distance from the ground, and the stems showing a considerable decrease in girth towards the top. This renders the process of lopping and the preparation of the logs more difficult and expensive.

12. *Gnarled and stunted trees in upper Kunawur.*—Another feature in the growth of the trees in upper Kunawur is note-worthy. Many trees in the vicinity of villages and in other localities easy of access, are gnarled and stunted. The stems, instead of being straight, divide into numerous branches, each forming a separate leader. This division sometimes takes place near the ground, sometimes at a height of from 10 to 20 feet. These leaders again form tall and well-shaped tops, so that at a distance the forest frequently has a deceptive appearance. The trees appear to be tall and well formed, whereas on approach they are found to be worthless for timber, being only the branches of a short stem. Occasionally well grown trees of good size are found in this mass of useless and gnarled Deodar jungle. This circumstance, and the tendency

of the branches to form well-shaped tops, prove that the cause of this irregular growth cannot be ascribed to the soil or climatic causes, but must be sought in some extraneous injury. In one instance, on the right side of the Kashang Valley, it was evident that avalanches of snow had done the mischief by crushing the main stem of the trees, whereupon some of the lower side branches had taken the lead and attempted to form fresh stems. In a few cases wind and snow-fall may break the top. Such injury, however, commonly produces what are called tabulated or flat-topped trees, such as are frequently seen near Simla, and in Kunawur above Pangee, on the right side of the river.

13. *Practice of mutilating the trees.*—The peculiarity here noted must, in most instances, be ascribed to the hand of man. The tops of the trees are lopped off to furnish posts, beams, and shingles for house building; poles and branches for fences, and litter for cattle. Here, as in other parts of India, the people find it more convenient to cut the upper part only instead of the entire tree, which requires more labour in felling and dressing the timber. If a Deodar is felled close to the ground, no side shoots are formed, but if any branches are left on the stumps, some of them take the lead and throw out straight ascending shoots. In many instances, the cut is still visible, in others it is concealed by the bark of the side shoot having grown over the cut and joined itself with the bark of the stem below the cut. Specimens of such stunted and gnarled trees are found throughout Kunawur, but in the upper part of the valley they form large tracts, especially near Purbani, in the vicinity of Riba and Rispa, and on the right bank of the river above Rogi. These indications of former cuttings are most frequent near the borders of the treeless region, and in the more populous parts of the valley where the demand for timber and branches is greatest. There are other sources of injury which have impaired the value of the Forests in some localities, and have entirely destroyed it in others. One practice, *viz.*, the lopping of side branches to serve as litter for cattle, is common all over the hills between the Jumna and Sutlej Rivers, and reduces the trees to a bare pole with a small tuft of branches at the top.

14. *Cutting and burning the Forest for cultivation.*—Another general custom is that of cutting, charring, or burning parts of the Forest for cultivation. The trees are either felled and burnt, as far as they will burn, or ringed and lopped, the branches being heaped round the stem and fired, or they are merely charred without ringing them. Substantially, this destructive practice is the same as what is called Toungya cultivation in Burmah, Dhya in Central India, and Koomree in Madras. One or two crops are taken off the ground, which is then allowed to lie waste.

15. *Rate of Growth.*—Having thus noted the distribution, the dimensions, and the appearance of the Deodar, and the principal injuries to which the tree is exposed, I proceed to discuss the rate of growth, that is, the time required by the tree to attain a sufficient size for the yield of timber. It has been agreed, for the sake of convenience, in several provinces of India, to adopt an uniform classification of trees. In the present state of Forest Conservancy, these classes are useful; hereafter, when the work is placed on a more rational basis, they will no longer be required. They are as follows:—

1st Class.—Six feet in girth and upwards.

2nd Class.—From 4 feet 6 inches to 6 feet in girth.

3rd Class.—From 1 foot 6 inches to 4 feet 6 inches in girth.

4th Class.—Below 1 foot 6 inches in girth.

All trees are measured at 6 feet from the ground.

The rate of growth of the Deodar in the different parts of the Kunawur Forests was one of the special points of enquiry. Including those examined in neighbouring Forests, upwards of 380 trees and logs were examined and the rings counted. A page of the register kept is given to illustrate the method followed in making these observations and recording them.

Register of Trees examined in a part of the Bespa Forests.

Forest.	Limbatang Forest.	Serkinchr Forest.														
No. of Survey.	36.	37 to 39														
No. of Trees.	1.	1.	2.	3.	4.	5.	6	7.		8.		9	10.	11	12.	13.	14.
Rings counted on successive portions of the radius between centre and circumference. 0″ to 2″	15	10	...	...	...	11	8	17	7	7		13	35	13	...	12	...
2″ to 4″	12	10	..	..	..	9	21	13	7	7		18	25	16	..	16	...
4″ to 6″	13	9	...	...	..	7	16	10	9	9		16	27	15	..	13	..
6″ to 8″	17	11	...	..	...	10	10	13	5	5		13	55	24	...	13	...
8″ to 10″	19	10	.	...	...	12	21	11	6	6		18	24	28	.	20	...
10″ to 12″	10	18	...	...	...	17	17	16	8	8		19	31	26	.	13	...
12″ to 14″	...	...	...	...	...	...	...	20	23	23		18	...	22	..	10	...
14″ to 16″	...	...	...	...	...	...	...	26	14	14		32	...	...	..	...	...
16″ to 18″	...	...	...	...	...	...	...	16	10	10		..	...	...	...	...	...
18″ to 20″												Note. Nos. 10, 11, 13, 14 had grown on a steep slope facing the south at an angle of 30°.					
Total rings	86	68	65	65	67	66	93	142	100	89	47	147	200	144	97	217	89
Radius ...	11″	12″	...	...	...	12″	12″	21″	8″	17″	..	16″	12″	18″	13½″	24″	6½″
,,	12″	15″	...	..	...	13″	14″	17″	9″	17″	...	25″	14″	10″	12″	19″	8″
,,	11″	...	...	..	...	...	...	23″	...	19	...	19″	15″	16″	7″	...	9″
,,	...	...	...	...	...	...	...	18″	...	...	...	25″	...	...	...	...	..
Mean radius ...	11·3″	13·5″	...	..	...	12·5″	13″	19·75″	8·5″	17·0″	5″	21·25″	13·6″	13″	10·8″	21·5″	7·8″
Measd. Girth ...	6′2″	7′7″	7′0″	6′8″	7′6″	6′10″	6′10′	11′9″	5′	10′6′	3′	12′4″	7′5″	...	5′9″	8′8″	5′3″
Calcd. Girth ..	6′4″	7′6″	...	...	...	7′	7′2″	10′9″	4′10″	9′7″	3′	11′6″	7′6″	7′2″	6′1″	11′8″	4′6″
Length of stem ...	73′9″	...	...	...	...	...	..	...	...	...	...	... ...	...	...	...	...	...
Age.																	
1st Class ..	82	53	50	60	54	53	82	67	...	36	...	83	173	104	80	150	102
2nd Class. ...	55	39	38	45	41	36	54	51	...	27	...	59	137	65	52	113	76

Aver. on level ground (1 to 9, and 12). 1st Cl. 62. 2nd Cl. 44.

Aver. on the steep slope (10, 11, 13, 14) 1st Cl. 132. 2nd Cl. 98.

An abstract of the trees examined giving results only, is entered in Appendix III with a summary Appendix IV, exhibiting the Forests arranged according to the more or less rapid rate of growth of the Deodar trees.

16. *Rate of growth generally slow.*—The general result of our investigation indicates an exceedingly slow rate of growth in most Forest Districts of the Sutlej valley. This must be attributed, partly to the very steep slopes on which the trees are growing, partly to climatic and other influences not yet sufficiently understood. For the sake of comparison, a number of measurements made in the Deodar Forests of Jaonsar Bawur, and in several Forest tracts near Simla have been added, and also some measurements of Ravee, Chenab, Jhelum, Cabul, and Swat River timber. The trees measured were generally selected as average specimens, after a previous observation of the width of the annual rings, as noted on logs, stumps, and pieces of wood lying on the ground. To obtain average results, it is important to exclude all cases of extremely slow or rapid growth, as the variations of size in trees of the same age and standing on the same plot are very great. Another plan would be to take trees at random, to measure them by thousands instead of by hundreds, and to rely on averages. Where time is limited, this would be impracticable and the results would rarely repay the time and labour expended.

17. *Rate of growth at different ages of the tree.*—In most cases, the annual rings are wider near the centre of the stem than near the circumference. Most trees, while young, grow more rapidly than afterwards. This is a general law, but the difference in the rate of growth of a tree in the earlier and later stages of its life, is less marked in Deodar than in many other

kinds. Teak, for instance, which in Burmah is supposed to attain in from 60 to 70 years a girth of 6 feet or a radius of 12 inches under favourable circumstances, attains not rarely a girth of 2 feet, or a radius of 4 inches in ten years, and afterwards decreases in its rate of growth.

The following tabular statement shows the number of years required to attain a radius of 4 inches by 122 trees examined in the different Forest Districts, and the number of years which elapsed between the formation of the sixth and tenth inch of radius. On an average, the former was accomplished in the trees measured in 40, and the latter in 50 years, and against 94 trees where the rate of growth decreased at a more advanced age, we have 28 trees with a less rapid growth while quite young. In some instances, where this anomaly was observed, the soil of the Forest was exceedingly poor, and possibly the trees of the Forest that sprung up first had to struggle against this disadvantage, but as the Forest grew older, the soil would gradually improve by the accumulation and decay of trees and other debris.

Statement of the number of Rings counted on 4 inches of Radius near the centre, and on 4 inches between the sixth and tenth inch.

	Name of Forest.	No. of Trees.	No. of Rings between centre and 4th inch.	No. of Rings between 6th and 10th inch.	Remarks.
1	Nagadar	8	16	22	Note.—The trees where the outer wood shows a more rapid rate of growth than the wood near the centre are marked.*
2	Nachar	1	35	73	
		1	24	48	
3	Janee...	1	25½	38	
4	Phiula	1	34	76	
		1	42	48	
5	Wasankan	1	84	58*	
		1	37	78	
6	Kilba...	2	43	56½	
7	Sloang	3	22	34	
8	Chasoo	1	32	19*	
		1	32	33	
9	Chidu	1	19	23	
		1	23	12*	
10	Limsantang	1	27	36	
11	Serinche	7	31	38	
		2	22	17½*	
12	Rakcham	2	28½	56	
13	Mebar	2	24	36	
		1	61	36*	
14	Barunalang and Simoling ...	3	42	58	
15	Tinala	4	33	54	
		1	58	46*	
16	Kashang	1	46	35*	
		1	36	40	
17	Kadelli	1	37	32*	
18	Chaog	2	32	36	Taking the 4 rings from the 8th to the 12th inch, the average of the 4 trees in the Chaog Forest is: Rings from Centre to 4th inch, 40. 8th to 12th inch, 21.
		2	48	23*	
19	Ropur Depôt... ...	2	24	31½	
		1	36	27*	
20	Jaonsar Bawur ...	6	20	27	
		4	32	22*	
21	Bhagaruttee	1	82	104	
22	Ravee	6	31	50	
		2	76	58*	
23	Chenab	27	39½	54	
		8	47	41*	
24	Jhelum	2	25½	31½	
		1	42	29*	
25	Swat River	7	47	66	
		1	55	54*	
	Total	122			

122 trees examined, *viz.*, 28 with an increasing, and 94 with a decreasing rate of growth.

18. *Rate of growth in different Forest Districts.*—The figures of this statement also exemplify the great discrepancy in the rate of growth in the different Forest Districts. These data are, however, given in a more complete manner in the following statement illustrating the rate of growth in each Forest District. The age of a first class tree with a girth of 6 feet, and that of a second class tree with a girth of 4 feet 6 inches, with the number of years which the tree requires to increase from the smaller to the larger size is here shown, and forest tracts are arranged according to the more or less rapid growth of the Deodar. Where the annual rings were counted in detail on the successive portions of a radius, the results were calculated from these data, but where the total number of rings only was counted, the age at 6 feet and 4 feet 6 inches was calculated by simple proportion. In a few instances, trees were examined exhibiting extremes in the rate of growth, but these are omitted. It is not supposed that the data exhibited in this statement correctly represent the average rate of growth of the trees in the different Forest Districts; they only do so to a certain degree, the results here exhibited must be regarded as merely preliminary, and as subject to correction, when a larger number of observations becomes available. As the results stand at present, three groups of Forests may be distinguished, according as the trees have a slow, a rapid, or a moderate rate of growth; a moderate rate of growth being that when a tree attains a girth of 6 feet in from 110 to 160, and a girth of 4 feet 6 inches in from 80 to 100 years. As far as the Sutlej Forests are concerned, the following may be regarded as the principal results of these enquiries:—

1st.—The majority of slow growing Forests were found above the junction of the Buspa with the Sutlej River.

2nd.—The majority of Forests, with a growth more rapid than the assumed average, are found in the Buspa valley and below it.

Reviewing the results in a general way, it is apparent that, in the Forests situated on the outer ranges of the Himalaya, Deodar grows more rapidly than in those which are at a greater distance from the plains. It will also be observed, that the Forests further to the north-west show a slower rate of growth than those further to the south-east. Thus there are among the Forests with slow growing trees, the Bhagaruttee Forest below Gungootree, nearly all the upper Sutlej Forests above Chini, and the Forests on the Swat and Cabul Rivers; if we may judge by the Bhagaruttee timber examined in 1863 by myself and in 1865 by Mr. A. D. Campbell, and by the Cabûl and Swat river timber, examined by me near Peshawur in November 1864. Among the Forests with rapid growth we find those in Jaonsar Bawur, all the Forests between Simla and Nagkanda (Simla, Chaog, Kadelli, Nagadār) and most of the lower Sutlej Forests. This is exactly what might be expected. In the moist climate of the outer ranges of the Himalaya the trees grow more luxuriantly, and form wood more rapidly than in the dry hills of the inner ranges, and of the extreme north-west beyond Peshawur. There are, however, notable exceptions to this general rule, which show, that although the rate of growth to a great extent depends on climate and geographical position, these are not the only determining agents in this matter.

The exceptions are as follows:—Some trees in the Phinla and Kiuden Forests, in the lower part of the Sutlej valley, were found to have a remarkably slow rate of growth, the average being 154 years for a girth of 6 feet. In the Nachar Forest, lower down the river, the average of 31 trees gave 149 years. In all these Forests the trees had grown up close together, and thus impeded each other's growth. Among the Forests with a rapid rate of growth, the Jhelum is recorded with only 97 years as the age of a tree 6 feet in girth. This is the result of the examination of four logs only, but it was confirmed by a careful inspection of a large quantity of timber collected at the depôt near Jhelum. The greater part of this timber had come from the Nainsookh River in Kaghan. Larger quantities of timber from this and the other tributary streams of the Jhelum River should be exmined. The geographical position of these Forests would lead us to expect a slow rate of growth.

The other exceptional instance of a quick rate of growth is that of some trees measured in the lower part of the Yolinge Forest above Poari on the left side of the river. It is supposed that these trees had grown more rapidly because they stood on level ground.

Statement showing the average age of 1st and 2nd Class Deodars examined in the different Forests of Kunawur, and some of the adjoining Forests.

Forest.	No of trees examined.	Age of I class trees.	Age of II class trees.	Diff.	Remarks.
1. Bhagarattee { Exd. by Dr. Brandis ...	4	229	143	86	Forests with a slow rate of growth. Age of 1st Class trees above 140 years. Age of 2nd Class tree above 100 years.
1. Bhagarattee { Exd. by Mr. A. D. Campbell*	18	196	148	48	
2. Cabul River	13	214	158	56	
3. Skyamdangdang, Sutlej ...	3	189	142	47	
4. Yolinge (upper part of Forest) S.	2	177	133	44	
5. Barunalang S.	7	160	119	41	
6. Swat River	10	156	112	44	
7. Phinla, Kiuden S.... ...	7	154	110	44	
8. Manda (Jangi) S.	2	153*	115	38	
9. Chini S.	6	152	91	61	
10. Nachar S.	30	149	112	37	
11. Poari, Purbani, Akpa, measured at Ropur S. ...	9	145	106	39	
12. Kilba S.	5	138	100	38	
13. Sleepers from Chenab at Lahore Railway Station...	50	134	97	37	
14. Ravee timber, slow growth.	4	134	93	41	
15. Serinche, (steep slope) S. ...	4	132	98	34	
16. Drift timber, examined at Ropur S.	4	130	96	34	Forests with an average rate of growth. Age of 1st Class trees between 110 and 140 years. Age of 2nd Class trees between 80 and 100 years.
17. Tinala (Teedong) S. ...	7	130	91	39	
18. Rakchum S.	3	125	80	45	
19. Chenab, measured at Wuzeerabad...	39	124	88	36	
20. Rogi S.	15	119	86	33	
21. Dippi S.	2	117	88	29	
22. Yak Bursari S.	3	116	87	29	
23. Topan and Kashang S. ...	5	113	85	28	
24. Mebar S.	7	113	83	30	
25. Chuog	5	110	87	23	
26. Simla (north side young trees)	23	99	73	26	
27. Jhelum	4	97	71	26	
28. Kadelli (between Muttianah and Nagkanda)	1	94	85	9	
29. Simla, (south side) ...	9	91	67	24	
30. Kumkumee, Shoang S. ...	10	91	66	25	
31. Ravee timber, good growth	4	91	62	29	Forests with a rapid rate of growth. Age of 1st Class trees below 110 years. Age of 2nd Class trees below 80 years.
32. Kilba, Dippi, Kusthal (Ropur) S.	8	90	66	24	
33. Junee S.	3	80	56	24	
34. Yolinge (lower part of Forest) S.	2	76	57	19	
35. Jaonsar Bawur	17	71	53	18	
36. Simla, (north side, large trees)	7	71	52	19	
37. Taranda	4	67	49	18	
38. Chasoo Limsantang S. ...	6	65	47	18	
39. Serinche, (level ground) S.	10	62	44	18	
40. Nagadar	8	50	34	16	
Total ...	380				

Note.—The Sutlej Forests are marked S.

* Received while this Report was printing.

19. *Slow growth on steep slopes.*—The more or less steep gradient of the slope on which the trees are growing, seems to have a great influence on the rate of growth. In several instances we observed that on steep slopes the average growth was much slower than on level or gently sloping ground.

This was exemplified in a remarkable manner in the survey of the Serinche Forests, in the Buspa valley above Sangla. Part of the Forest is on steep slopes, but the greater portion covers undulating land along the river bank, the average age of the trees measured in these localities was:—

	Age of 1st Class.	Age of 2nd Class.
On level ground 10 trees, average	62 years	44 years.
On steep slopes 4, „ „	132 „	98 „

The measurements made in the Rakcham Forest, a small tract near the upper limit of the Cedar in the Buspa valley, where the trees grow on a sandy flat near the river, seem to contradict the above, the age of a first class tree being 122, and that of a second class tree 79 years. But here the soil is poor and water-logged. No data were obtained to show the influence of absolute elevation on the rate of growth, but it is known that, as a rule, the annual rings are more narrow at elevations near the upper limit of the tree.

The time required for a tree to increase from the second to the first class corresponds to the general rate of growth. In the quick growing Forests, this time varies from 16 to 29, and in those with slow growth from 37 to 86 years. In framing the plan for working the Forests, 35 years will be assumed as the average.

20. *Average rate of growth of first and second class trees.*—The practical result of these enquiries concerning the rate of growth of the Deodar in different Forest Districts, and under different circumstances, is that in the majority of the Forest Districts in Bussahir, the age of a first class Deodar 6 feet in girth is between 110 and 140, and that of a second class tree 4 feet 6 inches in girth between 80 and 100 years. To frame the preliminary working plan, it is necessary to adopt certain figures indicating the average rate of growth; for this purpose 90 years will be assumed as the age of a second, and 125 years as that of a first class tree. From the preceding remarks it is apparent that, comparing equal areas in different parts of the Forests stocked with the same number of trees producing timber of the same quality, and offering the same facilities for export that tract will be more valuable where the rate of growth is more rapid.

21. *Average rate of timber production per acre.*—In the following statement the average annual timber production per acre in several Forest tracts of Bussahir and Jaonsar Bawur is shown. In the Nachar and part of the Kiuden Forest, for instance, the average annual produce of marketable timber amounts to 50 cubic feet per acre. The same rate was found in Jaonsar Bawur, though the rate of growth was much more rapid, but the places examined are not well stocked with timber.

Forest.	Area surveyed in acres.	No. of trees counted.		Length of stem available for Timber.		Coefficient by which butt girth was multiplied to find mean girth.		Average content per tree.		Total cubic content I. and II. Class.	Cubic content per acre.	Age of Forest.	Average annual production per acre.
		I. Class.	II. Class.	I. Class.	II. Class.	I. Class.	II. Class.	I. Class.	II. Class.				
				Ft.	Ft.			C. ft.	C. ft.	C. ft.	C. ft.	years.	C. ft.
No. 7. Mayshak Forest, Jaonsar Bawur ..	0·68	10	27	60	30	..	..	100	25	1,700	2,464	70	35·20
„ 10. Above Khattowa Village, ditto ..	0·46	20	12	50	25	0·70	0·70	72	18	1,656	3,604·35	84	42·90
„ 19. Chilara Jungle, ditto	0·34	11	13	60	30	0·80	0·80	103	26	1,470	4,323·53	83	52·09
„ 8. Nachar Forest, Kanawur	2·30	83	16	80	30	0·80	0·80	218	66	23,605	12,480·96	250	49·75
„ 23. Kiuden Forest, ditto	0·327	19	11	60	30	0·80	0·80	142	34	2,934	8,972·48	186	49·35
„ 24. Ditto ditto	1·60	57	33	60	30	0·80	0·80	142	33	8,820	5,512·50	180	30·62

22. *Difference between measured and calculated girth.*—In the statement given in Appendix III of the trees examined to determine rate of growth, two columns will be found marked "measured" and "calculated girth." The figures in the latter column are calculated from the measured average radius of the wood without the bark. In thus calculating the girth, an allowance must be made for the bark, and this allowance has been fixed at five inches. The average thickness of the bark in Deodar trees of the first and second class is about half an inch, but the irregular portions round which the measuring tape must pass, are frequently more than one inch thick.

An uniform thickness of half an inch would require an addition of 3·14 inches, if it measured 2 inches, 6·28 inches would have to be added.

In the following statement, average values of measured and calculated girth of trees examined in different Forest Districts are placed side by side, and it will be seen, that, upon the whole, they agree very well.

This statement is not at present of any practical importance, but will be so hereafter when the best mode of measuring Deodar trees, by the girth or by the diameter, comes to be determined.

Statement showing the difference between the measured girth of Deodar trees and the girth calculated from the radius.

Forest.	No. of trees.	Measured girth.		Calculated girth.	
		Feet	Inches.	Feet	Inches.
Nachar	31	6	4	6	3
Dippi	2	6	9	7	2
Janee	3	10	2	8	11
Phinla, Wasankan, Kiuden	4	7	2	6	6
Kilba	1	10	4	8	3
Kumkumee Sapni, Būrū	3	7	1	6	11
Rāpur, Jungari, Shoang					
Chasoo, Chidū, Limsantang	6	9	7	9	7
Serinche (on level ground)	7	7	9	7	6
Serinche (on the steep slope)	8	7	1	7	11
Rakcham	3	7	11	7	8
Yak Bursari	1	4	2	4	3
Mebar	6	7	6	7	2
Yolinge near top of Forest	2	8	11	9	3
Yolinge near lower part of Forest	2	6	6	6	10
Barūnalang, Simoling, Peadun	5	7	10	7	6
Tināla Teedong valley	7	8	3	7	11
Manda Forest of Jangi	3	8	9	9	7
Skyamdangdang	3	7	3	7	3
Topan, Kashang	4	5	2	5	7
Forest above Chini	5	5	3	5	5
Rogi	24	4	8	4	8
Chaog	2	8	5	8	9
Jaonsar Bawur	16	6	10	6	9
Bhagarūttee	1	5	9	5	7
Total	144	175	5	173	2

The measured girth is larger in 12 cases, being the average of 87 trees, it is equal to the calculated girth in three cases, being the average of 33 trees, and it is smaller in nine cases, being the average of 24 trees.

23. *Thickness of Sapwood:*—The Sapwood of Deodar is distinctly marked, and is much less durable than the Heartwood. Its thickness varies from 1½ to 3 inches. In logs left lying in the Forests, the Sapwood commences to decay after the exposure of a few years, but nowhere did we observe a decay of the Heartwood. The thick layer of Sapwood acts as a protection to the timber when passing down rocky slides, and while rubbing and bumping

against the rocks in the river. When this protecting coat of Sapwood has been destroyed, logs are much more liable to injury during their transit to the river, and down river to the depôts in the plains.

24. *Character of the vegetation in the Deodar Forests.*—The character of the vegetation generally in that part of Kunawur, where the more important Deodar Forests are found, has been described by Dr. Cleghorn in his Report on the Sutlej valley, I need, therefore, only mention the principal trees associated with Deodar, or found in the vicinity of the Deodar localities.

Appendix No. VII, contains a list of the principal trees and plants found near the Kunawur Deodar Forests, with their upper and lower limits as far as they could be ascertained. This list was prepared by Dr. Stewart partly from his own observations, and partly from statements of the inhabitants of the valley. The native names are those used in Kunawur between Nachar and Lipi. A few of the systematic names entered in the list may require correction hereafter.

25. *Pinus longifolia and Gerardiana.*—Of the Pines, *P. longifolia* skirts in light Forests, the trees standing far apart, the lower slopes of the hills on both sides of the Sutlej river as far as the Wangtu bridge, where this tree reaches its upper limit in the valley. A few miles higher up, below Chergaon on the right, and below Janee on the left side, *Pinus Gerardiana* commences. This tree, like *P. longifolia*, requires a large amount of light, and does not form dense Forests like the other Pines of these hills. It occupies the lower slopes of the mountain sides near the river, and is sometimes found intermixed with Deodar. We found this tree in greatest abundance between the junction with the Sutlej of the Buspa and the Teedong, covering the lower slopes of the hills on both sides of the river. The largest specimen which we observed had a girth of 9 feet; the stems are generally short, and divide early into branches. Its upper limits are said to be the Hangarang ridge on the right, and the village of Dabling on the left side of the river.

26. *Pinus excelsa.*—Of the other pines, P. *excelsa* (Lim) is probably the most common. It is frequently found mixed with Deodar and in many localities forms Forest tracts of considerable extent, both below and above the Deodar belt. In the Buspa valley Deodar ceases at an elevation of about 9,500, but Forests of Lim grow considerably higher up, both at the bottom of the valley and on its sides. In the Forests on the left side of the Sutlej above the mouth of the Buspa, *Pinus excelsa* commonly forms the main portion of the Forest between the Deodar and the Alpine Birch, *P. excelsa* does not, however, extend as high as Deodar, it ceases on the right bank at Soognum, and on the left at Namgia. Thomson mentions a stunted tree on the north-east side of the Runang pass at an elevation of 12,500 feet.

27. *Abies Smithiana.*—*Abies Smithiana* (Ryung) has its upper limit in the Sutlej valley near Pangi on the left and near Rispa on the right side. In the lower portion of the Forests it is frequently found associated with Deodar. This tree forms a large proportion of the Forest in the Dippi, Janee, Punang and Sapni Forests, also in some of the Forests of the Buspa valley, and in the Barung Forests above the mouth of the Buspa. Above this *Pinus Gerardiana* takes its place in the Deodar Forests.

28. *Picea Webbiana.*—*Picea Webbiana* (Span, Pan, Krok) is said to have its upper limits at Lipi on the right, and Dabling on the left side of the valley; below and frequently mixed with the Alpine Birch, this tree forms a part of the Forests near the upper limit of arborescent vegetation. The variety with short leaves, more uniformly arranged round the branch, is found in the more elevated situations. The other form with longer leaves and a more distichous arrangement is commonly met with lower down.

29. *The different species of Pines retain their leaves for different periods.*—*P. Webbiana* and *A. Smithiana* are the two pines which in these hills retain their leaves longest. The shoots of successive years can easily be distinguished on a vigorous branch. On the north-west side of the Harang pass on the road from Sangla to Mebar, near the limit of arborescent vegetation, a Forest of tall Piceas grows below the Birch. Here we found parts of branches 13 years old covered with leaves still green, and occasionally scattered leaves on branches 14 and

15 years old. Lower down the hill the limit is from 8 to 10 years; this we found in Kunawur to be the usual age at which the leaves of Picea and Abies are shed. *P Gerardiana* and *longifolia* retain their leaves from 2 to 3 years. *P. excelsa* appears to retain them somewhat longer, and the Deodar clears its branchlets at the age of about 5 years. This peculiar feature is within certain limits well marked in the coniferous trees of Europe and North America; it gives a peculiar character to the foliage and indicates the requirements of the different species regarding light and shade. *Picea* and *Abies* with their dense foliage thrive in more close and dark Forests than *P. longifolia* and *Gerardiana*, and their seedlings spring up, other circumstances being favourable, with a small allowance of light. These facts are noted to direct the attention of Forest Officers to a curious feature in the life of Coniferous trees not entirely without practical bearings.

30. *Taxus, Cupressus, Juniperus.*—The Yew, *Taxus baccata* (Yamdal) is met with here and there at elevations exceeding 9,000 feet.

The *Cypress (Cupressus torulosa)* is not found in Kunawur; there is a small Forest of this tree on the Shali mountain near the Sutlej River. The arborescent Juniper (*Juniperus excelsa*) commences a little below the upper limit of the Deodar Forests. It is found on the north side of the Teedong stream opposite Rispa, and on the south-west side of the Werang pass, in both cases at an elevation of about 10,000 feet.

31. *Oaks, Quercus Species.*—Of Oaks, *Quercus Ilex* (Brū) is one of the characteristic trees of Kunawur. It begins below Chergaon on the right, and Panwi on the left side of the valley, and clothes the lower slopes of the hills, commonly in company with *P. Gerardiana*, as far as Purbani, where it has its upper limit. It is always a small rigid tree. The largest specimen we measured, was in the Kilba Forests (No. 26 of Appendix I.) which was 6 feet 10 inches in girth and had a clear stem 20 feet high.

Quercus semicarpifolia—is not met with on the Sutlej above Kunai. On the Buspa we found a Forest of it between Sangla and Rakcham on the right side of the valley.

Of Q. dilatata (Marghang) a few cultivated trees only were found near Janee.

Q incana (Bān) has its upper limit opposite Chergaon.

32. *Fraxinus, Olea, Buxus.*—A characteristic tree of the lower slopes between the river and the Deodar Forests is the small leaved Ash, *Fraxinus Xanthoxyloides* (Thūm), it is of small size, frequently only a shrub, and grows as far as Spui and Namgia, considerably higher than Deodar. *Olea ferruginea* Wili is also found on the lower slopes near the river. It is said to ascend as far as Rarang and Riba, but we did not observe it above the mouth of the Buspa River.

Boxwood.—Buxus sempervirens (pāprang) seems to be scarce in Kunawur; we only found it in one place on a flat near the river and on its left bank below the village of Punang. The trees were too small to be of value.

33. *Trees found in moist places near Deodar Forests.*—The following trees are found in moist places near the Deodar producing tracts, mostly in the lower division of the Forests. *Populus ciliata* (Krammal) a tree 3 feet 2 inches in girth at the butt examined in the Buspa Valley above Sangla was found by the annual rings to be 53 years old. The upper limit of this tree is said to be Rarang. Several species of Acer and *Rhus. Alnus Nepalensis (Nyū)* upper limit near Spui and Namgia. *Cedrela Toona (serrata)* not found above the Dippi Forests. *Prunus Padus* as far as Sangla on the Buspa river. *Arundinaria utilis* (Spyūg) the hill bamboo grows on the road to the Shatool Pass above the village of Panwi.

34. *Betula Bhojputra.*—The Alpine Birch, (Shāk, Shag) occupies the upper limit of arborescent vegetation throughout Kunawur where the soil is not too arid.

35. *Low scrub springing up in Forest clearings, injurious to the reproduction of the Forest.*—The low scrub, springing up on the ground from which Forest has been removed differs remarkably in the lower and upper portions of the valley.

In the Nachar, Dippi, and Kusthal Forests, and higher up as far as the Buspa River, a dense scrub of Abelia, Berberis, Lonicera, &c., follows the axe of the wood-cutter wherever the whole mountain side has been cleared at once. In this scrub young Deodar rarely springs up, and a visit to these bare slopes where the natural reproduction of the Forest is now hopeless, and planting is prohibited by expense, would be instructive to those who maintain, that enough is done to satisfy the requirements of conservancy, if a Forest is allowed to enjoy rest, after all the large trees have been felled.

To ensure in these latitudes the reproduction of a Forest by natural means, it is necessary to give light gradually, leaving a large proportion of the trees standing, to furnish seed, and to shelter the seedlings that may spring up, and at the same time to prevent the luxuriant growth of the low scrub.

In the Upper Forest, the danger of wholesale clearing is less. Owing probably to the smaller fall of rain and less moisture in the atmosphere, very little scrub springs up. The ground in the Upper Forests is sparingly covered with scattered bushes of Lonicera, and tufts of Artemisia, Caragana or Astragalus. Seedlings spring up readily and are not liable to be choked by any dense undergrowth.

On the other hand jungle-fires appear to be more frequent in the upper portion of the Forests and the young self-grown plantations will have to be guarded with greater care against danger from this source. But upon the whole it appears, that if we succeed in clearing the Forests of the timber, tops and branches, during the same season in which the trees are felled, then, as far as reproduction is concerned, the working of the upper forests will be less difficult than the working of the lower portion.

36. *Forest valuation Surveys, their method.*—I now proceed to discuss the resources of the forests in detail, and to propose the plan of management. A description of the Forest tracts examined by us with valuation surveys will be found in Appendix No. I. These surveys give the number of trees of different classes counted on certain areas in the different forests. A few areas were actually measured; in most cases, the length of the track only was measured, on both sides of which the trees were counted, the width being estimated. These are usually called linear surveys, in hilly and broken ground they are generally more useful then the former, as the contents of a much larger area of the Forest can thus be obtained at the same expenditure of time. The survey of measured squares is expeditious in the plains on level ground, but requires more time in the hills, than could be spared in the present case. Actually measured areas were counted in two forests only, Nachar and Kiuden.

I may here mention, that the counting of individual trees, as is done in these valuation Forest Surveys is a *primitive and incomplete method for arriving at the valuation of any Forest. When the methods of forest management are further advanced in India, it will be abandoned,* and the valuation of a forest will then not be expressed by stating the number of trees, but the cubical contents of timber per acre, and the quantity which is annually produced on this area. But, under present circumstances, the method here described must still be used.

37. *Totals of trees counted in the Valuation Forest Surveys.*—Appendix No. II. gives an abstract of these surveys, with the estimated area and number of first class trees of each Forest District, and the proposed working divisions.

It will be observed, that in the aggregate 652 acres have been surveyed, and that 3,743 first, 4,099 second class trees, and 2,281 stumps have been counted on this area.

Excepting the Kashang Forests (Nos. 72 to 76) the tracts included in this preliminary survey are so situated, that with some improvement of the slides

their timber can be made available by rolling and throwing it into the river. Whenever the examination of a Forest District was completed, an estimate of the area covered by Deodar, and the number of first class trees standing on this area was made.

In Appendix VIII and IX. are given the results of an examination of the Jaonsar. Bawur Forests in the North Western Provinces made by me in June 1863. These papers are added, because it is desirable to unite in one volume all the available data bearing on the management of Deodar Forests in the Himalaya.

38. *Maps.*—The route pursued and the boundaries of the different forests were entered on the spot on a map, prepared on an enlarged scale from the degree sheets of the Great Trigonometrical Survey.

We had frequent opportunities of correcting the entries on the map and the estimate alluded to, by the excellent views of the sides of the Sutlej Valley which are obtained from elevated points and especially in returning on the north side of the valley. Nevertheless the map and estimates are only a rough approximation. They are given, because, without them, no working plan of the Forests could be framed and the plan here proposed could not be correctly understood.

39. *Working Divisions.*—The result of our enquiries is, that we assume the present stock of growing timber in the Forests immediately available to amount to about 58,000 first class, and an equal number of second class trees. These Forests we propose to divide into eight divisions, assumed to contain about equal quantities of timber.

40. *Previous working of the Forests.*—Before stating what yield of timber is expected from these eight divisions, it is necessary to inquire into the amount hitherto yielded by them. The first person who worked the Deodar Forests in Kunawur was Soda Sing This was about 1850. But no extensive fellings appear to have been conducted until 1859, when Mr. Arratoon and several others embarked largely in timber operations in this valley. We have obtained a list of the trees reported to have been felled in the different Forest Districts between 1859 and 1863. From this list are taken the details given in the Forest Surveys. The total number of trees stated to have been felled is 19,606. But in the Sapni Forest, where 447 trees are stated to have been felled, I counted, on the 22nd September, in a small portion of the Forest, 410 stumps, and in other instances also the large number of stumps counted indicates a larger number of trees felled than that reported. Altogether 2,281 stumps were counted in the Forests, and it should be noted, that, in selecting the tracts for examination, care was taken to examine those tracts which had not been extensively worked. On the whole, it may be assumed, that the number of trees felled is not less than 30,000. These trees have invariably been taken from the Forests easiest of access, and a large proportion of the Forests on the lower slopes of the hills have been entirely cleared out.

41. *Forest tracts completely destroyed.*—The following Forest tracts seen by us have been completely destroyed, so as to make reproduction impossible without expensive planting operations:—

1st.—Kusthal and Dippi, the lower part (Nos. 9-11, Appendix I).

2nd.—Punang, the western portion (Nos. 15-16.)

3rd.—Kilba, the lower portion (No. 26.)

4th.—Kumkumi and Sapni (No. 27), here the lower half of the Forest has been destroyed by fire. A few years ago the greater part of the large sized trees was felled but not removed. Fire entered in the dry season, and what was formerly a rich Forest with 33 first class trees on the acre, is now a barren slope covered with charred stumps and trees killed by the fire.

5th.—The lower part of the Shoang Forest, (No. 35).

6th.—A considerable portion of the Serinche and Yak Bursari Forest, (Nos. 37-39.)

7th.—The lower portion of the Tanglin Forest, (No. 49.)

8th.—The Kastiarang and Eastern Runang Forest, (Nos. 80-81).

Unfortunately a small portion only of the trees felled in these and other Forests has been made available for the market.

42. *Trees felled but not removed.*—In many Forests we found numerous trees felled but not removed. Thus in the Kilba Forest 115 stumps were counted, near 32 of them the trees were still lying as they had been felled several years ago. In the Serinche Forest, 20 out of 114 had been left lying on the ground. In the Simoling Forest, out of 49 trees felled, 10 only had been cut up and removed, the remainder were still lying on the ground. In the Kastiarang Forests 72 trees had been felled, but 92 logs, the produce probably of from 20 to 30 trees had been left on the ground.

43. *Logs left behind in the Forests and along the rivers.*—In the Nachar Forest upwards of 300 logs were found at the head of Mr. Arratoon's Slide, these had been cut in 1861, and the sapwood on most of them had decayed.

All along the Buspa River a large number of logs were found lying on the sands, which, with a small expenditure of labour might have been sent down. Large numbers were also seen stranded on rocks and sands in the bed of the Sutlej. If protected from fire, these trees and logs can be sent down and made available for the market.

44. *Logs injured and destroyed in their passage to the river.*—A large proportion, in many forests the larger half, and in some nearly the whole, of the timber is lost by being shattered to pieces, before it reaches the river.

Some of the timber slides examined by us were strewn with fragments of logs shattered on their passage downwards. Frequently large logs of two feet in diameter and upwards split from end to end, two half cylinders being the result. At the foot of a slide from the Ramni Forest, upwards of 1,000 logs and splintered pieces of logs were counted. A still larger quantity of timber was seen at the foot of the Dippi Forest Slide.

In visiting the Punang Forests we ascended the timber slide, and counted along the upper part of it 256 pieces and damaged logs. A larger number was scattered over the lower part of this slide.

Many similar instances of destruction of timber were observed, and upon the whole it appeared to us that of the timber felled in the forests, not more than half had reached the river.

45. *Reforms needed in the mode of working.*—The foregoing remarks on the present state of the forests, and the method hitherto observed in working them point to two matters, calling for reform in the plan of working :—

1st.—In selecting trees to be felled, and in felling and removing them, more regard should be had to the reproduction of the forest.

2nd.—The trees when felled should be lopped, logged, and launched, if possible, during the season in which they are felled, and the land transport should be arranged with more care to guard against the damage and destruction of timber.

The propriety of the second proposal will not be doubted; the first may possibly be objected to. It may be urged that the Deodar Forests are practically inexhaustible, that if those nearest the river are for the time being cleared out, the remoter forests will yield a sufficient supply of timber to last until the others shall have reproduced their former stock.

We must be prepared to meet objections of this kind at every step towards progress in Forest conservancy in this country. In the plains of the Punjab, the Rukhs, which yield the fuel for Railways, are considered by some inexhaustible, and the adoption of a methodical management unnecessary, because some localities are well stocked with trees and brushwood. Similar views are generally entertained regarding other Forests in India. In the Deodar Forests of Bussahir, however, the expediency of conservancy is palpable. Since 1859 upwards of 30,000 trees have been felled, and a

large proportion of the more accessible forests have been ruined beyond the hope of restoration. This has been accomplished in five years, and if the felling is continued at the same rate, ten years more will suffice to clear out and to ruin the whole of the forests available under the present system of working. We should then, in 1874, be reduced to those forests which require the sawing up of timber, artificial slides and roads for the land transport. Under a similar system these may last ten years more, but after 1884 the resources of the forests would be completely exhausted The tracts where young Deodar is springing up form a very small proportion of the original forests. Moreover these young trees in most forest districts will require upwards of 125 years to attain a girth of 6 feet.

46. *The duration of the lease may affect the working plan.*—The lease of the forests is for 50 years only. It may not be considered expedient to manage the forests leased under strict conservancy, and after the expiration of the term of lease to restore them to the Rajah in an improved condition at a considerable sacrifice of revenue. If, however, a prudent consideration of the future requirements of the country, is allowed its due weight, and it is decided to adopt a systematic management of these Forests, and thus to secure a steady and permanent timber supply, then I would propose the following plan of operations.

47. *Working Divisions, First Division, Nachar Forest.*—In Appendix No. II, the Forests now available are arranged in eight divisions; from each of these about 3,000 trees may be taken at the first felling without endangering the reproduction of the Forests, provided suitable arrangements are made. The First Division comprises all the lower Forests as far as the Melgad. This might be worked in 1865. In the Nachar Forest, which is the best in this Division, working commenced in 1864, and 300 trees were felled. It is supposed that in 1865 upwards of 1,800 trees more may be taken without injury to the Forest. When arranging the details of the working plan in this and other Deodar tracts, it should be borne in mind, that injury by fire and wind must be guarded against as much as possible. In the Nachar Forest, the trees have grown up exceedingly close, and if left isolated they are liable to be blown down by high winds. A belt of healthy trees should therefore be left standing on the outside of the Forest wherever practicable to afford some protection to the parts thinned out. On the lower edge of the Forest, openings would be made in this belt for the passage of the logs.

48. *Two methods of arranging felling operations.*—Within the belt, two methods of arranging felling operations might be adopted. The aim should be to afford sufficient light to enable seedlings to spring up, and to leave a sufficient number of trees standing for seed and shelter. Narrow descending strips, the width to be regulated by the character of the locality from one hundred to several hundred feet, might be cleared through the entire breadth of the Forest, alternate strips of twice the width being left intact. One-half of these alternate strips of forest would then be removed at a later period, when the young Deodar in the lines first cleared had attained a sufficient size to grow without shelter. The last portion of the old forest would be cleared when the trees grown on the part first cleared commenced to produce seed in sufficient quantity, unless it be found expedient to re-stock the Forest by planting. Further experience of Deodar Forests must guide Forest Officers as to the detail of this operation; it may be advisable at first, as a tentative measure, to leave a small number of trees standing in each strip cleared.

This plan can only be carried out in compact Deodar Forests where there has been little previous felling. As the operations of this season in Nachar were not conducted according to this system, it may be preferable to adopt another plan, and to select single trees, always taking the precaution to leave a certain number per acre, to be removed at some later period, either in one or in two instalments.

The first plan has this advantage that the timber can be moved out of the Forest, without disturbing the young trees, the whole or nearly the whole

of the timber on the ground being removed at once. It will also in many instances be found the more convenient plan for transporting the logs to the river.

49. *Necessity for clearing the Forest of timber, tops and branches.*—After the trees have been felled and trimmed, every exertion should be used to clear the Forest of the timber, tops and branches. If the latter cannot be utilized, they must be collected in heaps and burnt. If allowed to remain in the Forest, they serve to feed the jungle-fires. Unless care is taken, great loss may occur in the Nachar Forest owing to the large quantity of felled timber. If it be impossible to remove all the logs and branches during the season in which the trees are felled, then a path to keep out fires must be cleared round the whole Forest, and carefully kept free of combustible matter during the dry months.

Our aim should be to allow the Forest tract, (where felling operations have been conducted,) complete rest until it has re-stocked itself with young trees. Where natural reproduction does not effect this in a satisfactory manner, assistance must be given, by clearing away the brushwood, loosening the soil, sowing seed, or by regular planting operations.

The number of first class trees standing in the Nachar Forests is estimated at 4,000. About one-half of these will be left after the first instalment has been felled. A careful observation year by year of the state of the Forest will show, after what interval the second and third instalments should be felled.

50. *Other Forests of the first Division.*—The Soongree Forest also belonging to this Division, may be treated in a similar manner, and it is supposed that about 200 trees may be felled. The eastern part of the Division is composed of the Panwi, Dippi, Kusthal and Ramni Forests. The lower part of these having been cleared, only eight hundred trees are estimated as the yield of the first cutting which must be conducted with the greatest care, and only in the more remote tracts, where owing to local obstruction, timber has not been felled. These tracts are on precipitous mountain sides difficult of access, and water is scarce. Roads will have to be made, and rocks blasted, to form timber slides. From the preceding remarks it is apparent, that the working of the first division will require the undivided attention for one season of the Officer in charge of the Sutlej Forests.

51. *Second Division.*—The second division comprises the Janee, Punang, and Phinla Forests. Its boundaries are the Melgad to the west, and the Sdeeling-gad to the east. The Phinla and Janee Forests are almost untouched, and after slides have been prepared, felling operations might be conducted in descending lines as above indicated. The inferior Pines found in these and other Forests should not be allowed to stand in the strips cleared of Deodar, and if they cannot be utilized, they should be burnt with the tops and branches of Deodar. The terms of the lease fix a rate of Rs. 2 for every tree of other kinds felled, this refers only to timber which can be utilized, otherwise the loss would be considerable. If the other Pines are allowed to remain standing on the ground from which the Deodar has been removed, the Forest will speedily deteriorate. It is supposed that the second division will yield about 3,000 trees as the first instalment of felling operations.

52. *Third and Fourth Divisions.*—The third and fourth divisions contain the remaining Forests of the lower section in which there is a large extent of almost virgin Forest, *viz.*, the Jumpan, Wasankan, and Kiuden Forest, believed to be some of the richest of the available tracts in the valley, and hitherto protected by their situation with regard to the river and the intervening cultivation.

The obstacles are probably not insurmountable, but to ensure success the undivided attention of the Officer in charge of the Sutlej Forests should be devoted to this division for several reasons. It is believed, that the plan of clearing in lines, following the slope of the hill, may be adopted with advantage. According to the plan here sketched out, these divisions would be worked in 1867 and 1868, and as a first instalment 6000 trees might be felled.

53. *Fifth Division.*—The Buspa Forests form the Fifth Division; most of these have been extensively worked; the outturn of the first cutting may possibly not amount to 3000 trees, which must be selected with great care.

54. *Sixth Division.*—The sixth division comprises the Forests on the left side of the Sutlej between the Buspa River and the Shaengarang stream near Barang. A large portion of these (the Mebar and Barang Forests) have hitherto been considered unavailable, on account of the high precipice between the Forests and the river. The construction of slides here will be difficult, and will involve considerable outlay. If the obstacles can be overcome, it is hoped that upwards of 3,000 trees may be removed as a first instalment.

55. *Seventh Division.*—The Forests between the Shaengarang and Purbani are the property of Surjeet Sing, Wazir of Poari, whose father received them as a jaghir from the father of the present Rajah. On the supposition that a lease may be obtained of these Forests also, they are included, forming the Seventh division. One of these, the Stalimpi Forest, is exceedingly valuable. Being protected by distance from the river, and rocky boulders near its lower edge, it has never been worked.

56. *Eighth Division.*—In the last or eighth division are included a few good Forests near Purbani and the Dogri (Chalêt) of Simoling, the Forest near Riba and Rispa, the Teedong Forest and the whole of the available Forests on the right bank. If the present plan is carried out, these Forests would yield 3,000 trees in 1871.

57. *Provision made for* 16 *years.*—Thus an annual supply of 3,000 trees has been provided for eight years, that is until 1871, or for seven years, in case the Poari Forests cannot be leased. It must, however, be remembered that though the estimates on which the arrangement is based, are only rough approximations, in many instances depending on the possibility of opening out timber-slides from the different Forests, so much is certain, that 3,000 trees per annum is the maximum average which can be expected during this period. It has been stated that the whole number of first class trees in available localities probably does not exceed 58,000. Of these 24,000 will be removed during the first period, and it may be possible to fell a second instalment of the same number during the second period of eight years.

58. *Necessary modifications of the plan proposed.*—There will be unavoidable exceptions in carrying out the series of operations here sketched. Where felling is not conducted in regular lines, but where the trees are selected over the whole extent of the Forest, the second instalment may have to be felled before the expiry of eight years. Again, an unusual demand for timber may be expected occasionally to arise rendering it expedient to conduct operations in two divisions simultaneously, and thus to anticipate a crop properly appertaining to a later period. But an exceptional increase of the fellings should be equalized by a corresponding decrease in subsequent seasons, so as to keep within the average annual yield, as here proposed, or as may be ascertained by future experience. The systematic arrangements of felling by divisions may be objected to on the ground that it will delay the renewal of some of the more valuable forests, such as Nachar, Soongree, Janee, Phinla, Kiuden, and others which, in their present state, do not increase in any sensible degree. It might be thought preferable to conduct felling operations in all the divisions simultaneously, to give more room for the natural growth of young trees. This, however, would distribute the work of the season over a wide area of forests instead of concentrating it in one tract. The delay of a few years in commencing the work in the different compact Deodar Forests of Kunawur appears necessary in order to ensure careful and methodical management.

It may also be objected that planting operations on a large scale have not been included as part of the general working plan. Whenever nature fails to produce a young forest in a satisfactory manner, planting must be resorted to, unless the expense should be prohibitory, and it may be expedient to raise new Deodar Forests by sowing in localities, where, owing to the level ground and other circumstances, a rapid growth of the trees may be expected. This

may be considered hereafter when the revenue to be derived from the Sutlej Forests has been ascertained by actual experience.

59. *Review of the resources available after sixteen years.*—Assuming that the arrangement here proposed is carried out, only a small number of the trees now belonging to the first class will be left at the end of sixteen years. probably those trees only which, owing to unsoundness, or other circumstances, are not worth removing; but meanwhile a proportion of the second class trees will attain first class size.

It will be remembered that of the trees actually counted in the Kunawur Forests, 3,743 belonged to the first and 4,179 to the second class. We have also seen that taking the average rate of growth of the trees in these forests, 35 years are required for a tree 4' 6' in girth to attain 6' in girth, and as the trees of the 2nd class are not fewer than those of the first class, we may expect, that, in 35 years, the second class trees will replace those of the first class. This, however, is only partially correct, for many of the second class trees, on which the above assumption is based, were counted in compact forests, where their growth was retarded by the larger trees. In one instance (Kilba Forests, No. 26) a number of second class trees were observed on a sterile ledge of quartz rock where they evidently had attained their maximum size. In other localities, a considerable proportion of smaller trees were counted in less compact forests, where they were likely to grow into first class trees. At all events it is evident that, in arranging the working plan, we must provide for a regular supply of timber for at least the next 35 years.

60. *Resources of the Forests not at present available.*—Sixteen years have been provided for, and to meet the wants of the remaining 19 years we must look to the Forests not available under the present system of timber transport. No estimate can at present be framed of their contents, but it is supposed that they do not contain fewer first class trees than the forests immediately available. As none of these have been examined, except the Kashang Forests above Pangi, no classification can be made, but the following enumeration may suffice;—

1.—The Deodar Forests on the Pabur and its tributaries.
2.—The forests on the Nogri, Choundeh and other streams below Taranda.
3.—The forests on the Rupi, Shorang, Kandari, and other streams on the right side of the river below Wangtu.
4.—The Wangar Forests.
5.—The Melgad Forests. These are said to be extensive and rich in fine trees.
6.—The Punang Forests.
7.—The Barang Forests on the feeders of the Shaengarang.
8.—The Forests on the Tanglingad.
9.—The Upper Teedong Forests.
10.—The Kashang Forests.
11.—The Malgun Forests below Pangi.

The first step to make the timber of these Forests available, will be the introduction of sawyers, and the conversion of the timber into Railway sleepers to be carried to the river. In these hills one man frequently carries planks and other scantling measuring more than 3 cubic feet, and weighing about 120 lbs. Railway sleepers should be cut a few inches longer and one inch deeper and wider than the specified measurements. Pieces $10\frac{1}{2}$ feet long and 6 × 11" would require two men, but could always be carried even over difficult ground In the side valleys, it may hereafter be expedient to collect the timber at localities suitable for the establishment of water saw-mills, and from these points to make roads or artificial slides to the river. All these matters should be kept in view, and a number of sawyers should be employed from the first, partly for cross cutting the logs, which has hitherto been done by the axe, involving great waste of material, partly for sawing timber in localities whence otherwise no timber can be removed. This will afford an opportunity for testing the practicability of floating sawn timber down the Sutlej river without serious injury and for ascertaining the best season for doing this.

It will be apparent from the preceding, that unless great caution is used, the present resources of the Forests may be exhausted before the young trees (which, under good management, will spring up where the existing Forest has been cut down,) have attained maturity.

61. *Protection of the Forests against injury.*—Two subjects remain to be discussed ; *first*, how the Forests are to be protected from injury ; *second*, what arrangements are to be made to protect the timber floated down the river from depredation. Fires in Forests from which the timber had not been removed have hitherto been the greatest source of injury, and it is a matter for serious consideration what is to become of the Forests where large numbers of trees, tops and branches have been left on the ground. The risk is great, and it may be necessary to give notice that, if not removed by a certain date, the Forests will be cleared of old timber by the Forest Department at the risk and expense of the owners.

62. *Injury done to the Forests by villagers.*—These Forests suffer from other sources of injury, *viz.*, the practice the villagers have of cutting, charring or burning the trees for cultivation, and of mutilating them to obtain planks, poles and branches for fencing and litter for cattle. On these matters the lease contains the following provisions :—" The Zemindars shall be permitted to cut timber for fuel, charcoal, house building, and vine frames. They are not to be prohibited from cutting down the inferior Forests for purposes of cultivation."

63. *Demarcation of the Forests of superior value.*—It will be necessary to demarcate the Forests of superior value, to prevent their being cut down for cultivation. This may be done year by year in those Divisions where felling operations are being conducted. At the same time it may be expedient to place Rangers in charge of the different Forest Divisions who should be natives of the district. They should reside in or near the Forests under their charge, and it would be their duty to examine the boundary marks at stated times, to report, and, if possible, to prevent any encroachment on the boundaries ; they would prevent such damage or depredations as are prohibited in the lease, and would report any occurrence of note in the Forests.

Hereafter it may be possible to induce the villagers to fell such trees only in the demarcated or reserved tracts, as are pointed out to them by the Forest Rangers, who would be instructed by the Forest Officer as to the trees to be felled. Ultimately, when after 50 years the lease is renewed, a stipulation might be inserted, that the demarcated localities should be at the absolute disposal of the British Government, while the remainder of the Forests should be available for the free use of villagers.

64. *The right of collecting waifs and strays exercised by Native Chiefs.*—Under existing circumstances, the different Native Chiefs, whose territories adjoin the Sutlej river, exercise the right of collecting waif timber on the river. Logs or pieces which bear a distinctive mark are regarded as private property, but logs which bear no such mark, are regarded as the property of the Chief in whose part of the river they are caught. This right of collecting waif is leased out by the different Chiefs, and the aggregate payments at present are said to amount to Rs. 7,050 annually ; the detail is given in Appendix I, No. 85. The value of this right depends on the extent of river frontage, and the number of quiet reaches and other places in the river where timber either strands or can be brought on shore by men on inflated skins. Parties engaged in the timber trade on the Sutlej river complain that under cover of these leases, marks are effaced and others substituted on logs floating down the river, that timber is thus stolen from the rightful owner, and that this practice of piracy is the main cause of the insecurity attending the working of the Forests. It cannot be expected that, under these circumstances, persons with capital will embark in the trade as permit-holders, although, hereafter, when greater security is afforded to the timber on the river, and when the prospect of profitable working becomes more certain, it may be very desirable to leave to private enterprise the work of felling, cutting, and floating the timber from the Forests.

If the Sutlej timber be brought down by the Forest Department, the greatest care should be used to prevent the launching of any log or piece which has not been properly marked. If this is done, the value of the drift timber leases will probably fall, and the different Chiefs may then be induced to grant these leases to the British Government.

65. *Rules for the management of waif timber in British Territory.*—Rules for the management of waif timber on the Punjab rivers within British Territory have been promulgated. These rules might be amplified by prohibiting the seizing, cutting, and marking of timber on the river, or any interference with it by others than the owners, or their Agents, or persons specially authorized by the Deputy Commissioner of the District, or the Conservator of Forests. The Native Chiefs might be induced to promulgate these rules as law in their own territories, and thus to transfer the entire control of the waif timber in their jurisdiction to the British Government, in consideration of the annual payment to be made to them for the waif timber leases. If this can be arranged, guards might be stationed at those parts of the river where timber is easily caught, or washed on shore, to prevent transgression of these rules.

66. *Necessity of further sources of Deodar to supplement the Forests of Bussahir.*—The results of this enquiry show, that 3,000 trees annually is the maximum yield which can be expected for the next 16 years, and that it is doubtful whether, after this time, the yield can be maintained at the same figure. The average contents of these trees cannot be estimated at more than 75 cubic feet, or one ton and a half, so that 4,500 tons, or 225,000 cubic feet annually will be the outside that can be expected. It is hoped that, under careful management, a net revenue of Rs. 8 per ton or Rs. 12 per tree will be realized. The limit of the annual net revenue would thus, at present timber prices, be Rs. 36,000.

With the prospect of these small results, it seems desirable to review the Deodar localities between Bussahir and the plains. If anywhere nearer the plains, a sufficient extent of compact Deodar Forests could be found to warrant the construction of roads so as to render transport on carts possible, it might be expedient to rely on them for future supply, and meanwhile to work the Bussahir Forests with due care and economy of material, but without reference to their maintenance and reproduction. Forests in the outer hills have the great advantage of a more rapid rate of growth which would considerably enhance their value.

67. *Deodar localities between Bussahir and the plains.*—The Jaonsar Bawur Forests, between the Rivers Tonse and Jumna in the North Western Provinces, and the Forests on the head waters of these rivers in Native Gurhwal, will serve to supply the country on both sides the Jumna River; for the plains further west the Deodar Forests on the Choor Mountain Range between the Giri and Tonse Rivers might possibly be made available, and an early opportunity might be taken to examine their resources.

The Deodar localities on both sides of the line of watershed between Simla and Nagkanda are numerous, but not sufficiently extensive to warrant the expectation that they will ever prove a source of great importance. From two or three of these tracts, particularly from those north-west of the Shali Mountain, and near Komharsen, timber was brought to the Sutlej, before the working of the Kunawur Forests commenced.

In No. 83 of the Valuation Forest Surveys some of these tracts are enumerated, and in No. 84 a description is given of the Chaog Forest, a fine, but not extensive Deodar Forest, south-east of Fagu.

The Officer in charge of the Sutlej Forests must make the journey between Simla and the Forests twice a year, before the commencement and after the close of the working season; he might be instructed to examine in succession the principal Forest tracts in that line of country, including the valley of the Pabur, from which the Borenda Pass would take him into the heart of the Buspa Forests. This, and the survey of the Deodar localities on the Choor Mountain, would complete our knowledge of the Deodar resources in this portion of the Himalaya.

APPENDIX I.

Forest Valuation Surveys—Bussahir, 1864.

No.	Date.	Name of Officer conducting the Survey.	Locality.	Deodar. First class above 6 ft.	Deodar. Second class, 4½ ft. to 6 ft.	Deodar. Third class, 1½ ft. to 4 ft.	Deodar. Fourth class, small.	Deodar. Stumps.	Area Surveyed. Length in ft.	Area Surveyed. Width in ft.	Area Surveyed. Area in acres.	Trees per acre. First class.	Trees per acre. Second class.	Remarks.
1	...	———	Forests on the left bank of Sutlej below Soongree..	...	...	...	...	...	...	...	...	...	...	No surveys
2	Aug. 22	Dr. Stewart ..	Soongree	53	1	8	..	..	625	200	2·87	18·47		
3	„	„ „ „ ..	„	121	8	4	42	..	1052	200	4·83	25·05		
4	„	„ „ „ ..	East Nachar up the hill	341	402	324	..	..	1428	200	6·56	51·98	61·28	Dead, 15
5	„	„ „ „ ..	East Nachar across the slope at right angles	43	54	3	8	..	408	200	1·87	23·00	28·88	Dead, 15
6	Sept. 11	„ „ ..	West Nachar up the hill	91	111	87	Few	6	700	200	3·21	28·35	34·58	
7	„	„ „ „ ..	West Nachar across the slope at right angles to No. 6 ...	114	85	64	Few	,	800	200	3·67	31·06	23·16	
8	Oct. 10	Dr. Brandis and Capt. E. Wood ...	East Nachar ..	82	18	..	..	44	500	200	2·30	35·65	7·83	

Forests on the left bank of the Sutlej River below Soongree.

No. 1. On the flanks of the spur on which Taranda is situated, is a certain quantity of Deodar. Some has been felled for bridges. The stumps which were seen near the road showed a remarkably rapid growth. The age of a first class tree in this Forest, according to these observations, would be as follows :—64, 76, 84, 43—average 67 years. Some Deodar is also high up on the Choundehgad above the point where the road crosses this stream.

There is a large extent of Deodar Forest on the south side of the Nogri Valley, and a Forest, called Nagadār, is on the head-waters of the Beragad, north of the new road, and not far from the Kotgurh territory. In this Forest a large number of trees were lately cut by the road Engineers for the repairs of bridges near Nagkanda. The examination of the beams collected on the road, gave the following result—age of first class trees ; 61, 64, 54 :—average 59 years. There are many other Deodar localities on the Sutlej side of the mountain range, which forms the line of water-shed between the Pabur and Sutlej from Nagkanda to Serahn, but upon the whole this tree seems to be less frequent here than along the Deoban range, which divides the drainage of the Tons and Jumna Rivers in Jaonsar Bhawur. This range, however, is 40 miles further south, and its highest point rises only to 9,500 feet, whereas the peaks at the head of the Nogri valley attain an elevation of 17,000 feet.

Nos. 2, 3. *Locality.*—The Soongree, also called the Thāno Forest, is the first compact mass of *Deodar* of any size met with in ascending the Sutlej from Rampoor by the main road. It is a small forest of a somewhat oval shape situated close to the village of Soongree, about 2 miles north-east from Poinda, at an elevation of 7,000 feet above the sea, and at the foot of a steep rocky ridge, running down to the river from the higher hills above.

Both surveys were made across the slope of the hill on the longer diameter of the forest, and probably indicate nearly the average character of it.

The Deodar are almost unmixed with other trees. Small patches or single Deodar trees are scattered over the slopes and ridges between Soongree and Nachār, and it seems probable that a considerable part of this tract was at one time covered with Deodar, which has now, in a great measure, been cleared for cultivation.

Soil, &c.—The aspect of the hollow in which the Forest lies is N. N. E.; the slope is for the most part gentle (about 15° to 20°), and the soil is deep, over granitic rock. The whole ground retains marks of old cultivation terraces, and the village fields extend between the Forest and the river which is about ¾ths of a mile below.

Growth, &c.—Here stand, or have recently stood, some of the largest Deodars in Kunāwur, and the general size and shape of the trees are very good, being similar to those of the Nachār Forest. Those of the first class would yield, on an average, about six logs and are mostly straight and symmetrical, the branches commencing high on the trunk; some of the largest stems, however, are gnarled and branched. A considerable proportion of the first class trees are above 12 feet in girth.

This Forest is near a temple, to which it is said to belong, and has escaped the axe of the timber traders, but a few trees have been cut by Zemindars. Some arrangement may be needed to obtain permission to fell in it, and compensation will have to be given for the passage of a slide through the fields below. The physical difficulties in constructing a slide to the river will not be great, as the slope is fair and few rocks intervene. The Forest is of limited extent (say 20 acres) and probably contains under 600 first class trees. The proportion of young trees is small, this is probably the result of the closeness and height of the older trees, and the former will increase as soon as felling commences.

Nachar Forests.

Nos. 4—8. *Locality.*—Nachār is the collective name of a number of villages situated on the north and north-east slope of the hills facing the Sutlej River, opposite the mouth of the Kandari stream. The Deodar localities are on the slope above these villages, and extend over a length of about two miles to near the Wangtu bridge. The average elevation of the Forest may be estimated at 7,500 feet. The trees in the eastern portion are scattered over precipitous rocky ground; above the village there are two compact masses of Forest separated by waste and cultivation. The western portion may be designated as West Nachar. It is situated on a steep slope; the eastern portion is on terraced ground below, and on a steep rocky slope above.

Soil.—In the compact Forest the rock is granite. There seems to be a deep layer of soil enriched by the accumulation, undisturbed for centuries, of pine leaves, roots, and branches. It is apparent from the terrace walls still standing, that the lower part of the Eastern Nachar Forest was cultivated before the greater part of the Cedars had sprung up. Some trees are of much larger size than others, and may have existed before these fields were abandoned. They have grown very close together on good soil, and under very favourable circumstances, the stems have thus been drawn up to an unusual length, while they are not deficient in girth and rate of growth.

The size of the trees in the compact portion of the Eastern Nachar Forest is gigantic. The largest standing trees measured had the following dimensions :—

Girth.	Height of entire tree.
19′ 6″	250′
22′ 6″	204′
21′ 6″	178′
18′ 6″	213′
13′ 6″	205′

In the East Nachar Forest felling operations were commenced by the Forest Department during the present season, 300 trees were felled and 1,800 logs from 10 to 14 feet were obtained. Several trees gave 10 logs each. A larger proportion of logs would have been obtained if the loss from breakages in falling had not been so heavy. Upon the whole, it seems that a length of 80 feet may be calculated as available for timber. From a series of measurements made (Appendix V) it appears that if the girth or diameter is 100 inches near the butt, it is 80 inches at 40′, and 60 inches at 80′.

In determining approximately the cubic contents of the trees standing on a given area, the length available for marketable timber has been assumed at 80′, and the girth at $\frac{4}{5}$ths of the butt girth. In Survey 8 all trees standing and stumps of fallen trees were measured on an area 500′ × 200′, or 2·30 acres and the result was as follows :—

First class trees standing,	82 or 35·65	per acre.
Second „	18 or 7·83	„
Stumps of first class trees,	44 or 19·13	„
Total ...	144 or 62·61	per acre.

Thus there stood on one acre of this portion of the Nachar Forest, before felling was commenced, 54 first and 8 second class trees. The aggregate content of these 144 trees was ascertained to have been 28,605 cubic feet, or 12,437 cubic feet per acre. This, as explained above, excludes that part of the tree which is beyond a length of 80 feet as well as all

branches. Under existing circumstances, the top and branches cannot be turned to account, but, on the contrary, are an encumbrance. The average content of 126 first class trees standing and felled was 218 cubic feet, the largest being a felled tree with a diameter of 4′8″ and a content of 684 cubic feet. The average content of the 18 second class trees was 66 cubic feet.

The rate of growth of the trees in this Forest is very slow. The oldest tree, whose age was determined by counting the annual rings on the section of the stem near the ground, was 466 years old and measured 18′ 10″ in girth. Six trees between 9′ and 16′ 3″ girth were examined and gave the following figures :—

	Girth.	Rings.
	10′ 6″	227
	10′ 6″	223
	9′ 3″	327
	13′ 4″	347
	12′ 11″	210
	16′ 0″	307
Total ..	72′ 6″	1,641
Average ..	12′ 1″	273 ; this gives an increase in girth of 0·″53 per annum.

Four trees between 6 and 9 feet in girth were examined, and gave the following figures :—

	Girth.	Rings.
	8′ 0″	191
	7′ 0″	220
	7′ 8″	150
	8′ 3″	227
Total ..	30′ 11″	788
Average ..	7′ 9″	197 ; this gives an increase in girth of 0·″47 per annum

The majority of the large trees in this part of the Forest appears to be between 150 and 350 years of age. Assuming 250 years as the average, we obtain nearly 50 cubic feet per annum an acre as the average annual increase of timber up to date in this part of the Nachar Forest.

The time which the trees now standing on the ground required to attain a girth of 4′ 6″ and 6′ would appear to have been 112 and 149 years respectively, if the average is taken of the figures yielded by all the 31 trees measured, but it is probable, that the average rate of growth in this Forest has been more rapid than this. Taking the results of the trees measured on the 10th October, *viz.*, from No. 24 to No. 30, the age of a 6′ tree is 118, and of a 4′ 6″ tree 88 years. These trees were selected as instances of average growth, whereas among the smaller trees measured on the 22nd August, there appears to have been an undue proportion of extremely slow growth, as they had grown up overshadowed by the larger trees. Such instances are—

	Girth.	Age.
	7′ 0″	220
	2′ 4″	67
	5′ 0″	151
	5′ 4″	160
	5′ 8″	194
	1′ 5½″	61
	4′ 6½″	101
	3′ 5″	113
	1′ 4″	43
Total ...	35′ 8″	+1,110

Average girth 3′ 11″ with an age of 123 years or an annual increase in girth of 0″·38.

This exceedingly slow growth does not agree with the results obtained by measuring the larger sized trees, as shown above, nor does it agree with the results obtained on the 10th October.

General Remarks.—The area of the Nachar Forests was estimated at 200 acres, and the contents at 4,000 first class trees, before the felling operations of 1864 commenced. Out of these, 300 trees have been felled. The logs should be moved outside of the Forest as speedily as possible, and the tops and branches, if they cannot be utilized, should be collected and burnt. If this precaution is not taken, it may be difficult to protect the Forest against destruction by fire. With proper management, another instalment of from 1,500 to 2,000 trees may be felled in 1865, without serious injury to the Forest. Regarding the selection, the following remarks may be useful. It should be borne in mind that trees which have grown close together, are liable to be blown down by storms, and a belt of healthy trees should therefore be left standing for the present on all sides wherever practicable. Within this belt it will be sufficient to leave about 10 trees to the acre to shed seed, and to afford shelter to seedlings springing up. We observed that a considerable space within the eastern Nachar Forest had been completely cleared of trees, and that no seedlings had sprung up.

As the first season's fellings were carried on at random over a large portion of the Forest, it will not be practicable to arrange for lines to be cleared following the slope of the hill with belts of Forest left untouched between, which will generally be found an expedient plan of working the more compact Deodar Forests in Kunawur.

Ultimately, the trees left for shelter round and in the Forest must be felled and removed to give space to the young Forest. Experience and careful observation of the young trees must show when this can be done with the least injury. While young it is hoped that the seedlings will be sufficiently pliable, not to suffer materially by the felling of the trees and the rolling of the timber. It may be useful to fell the third and last instalment of the trees now standing on the ground, while the snow is lying and affords some protection to the young trees, provided the cold is not too severe.

It is supposed that the trees to be felled next season may be between 1,500 and 2,000, which, if all logs reach the Depôt in the plains, would give an out-turn of these two seasons of about 300,000 cubic feet or 6,000 tons of timber. It is not, however, believed that, under existing circumstances, more than one-half of the timber actually launched will reach the Depôt in the plains. To ensure the arrangements here proposed being carried out in an intelligent and efficient manner, it appears absolutely necessary that no tree should be felled in this Forest which has not been marked by the Forest officers in charge, and arrangements should be made to cut up the trees into logs, to move them outside the Forest, and to utilize or destroy by fire all tops and branches during the same season in which the trees were felled.

Former working of the Forest.—It is stated that 1,188 trees were felled in this Forest between 1859 and 1863 by Mr. Arntoon, Soda Singh, Wazir Goshain, and Surda. A large quantity of timber, besides that felled by the Forest Department, is lying in the Forest, belonging, it is said, to Mr. Aratoon and Surda. The last party has been working this year, and the greater part of his timber has been removed, but several hundred logs of Mr. Aratoon were lying at the top of his slide. They had been felled in 1861, and in most of them, the sapwood was completely decayed. The logs have been rolled down to the river by three tracks or slides. Two of these have been used by Mr. Aratoon, and one by Surda. These are mere tracks smoothed to a certain extent by the passage of timber. No outlay appears to have been incurred in permanently improving them. Though the ground is favourable, a proportion of the logs have been injured or destroyed before reaching the rivers.

A new slide was last season made by Government. The outlay consisted in—

1st.—Compensation to villagers as the slide passes through cultivation.

2nd.—Clearing brushwood.

3rd.—Smoothing the ground and removing stones.

Protection of the Forest against injury by cultivation.—In several places round the Forest, Deodar has been cut and burnt by the villagers for cultivation. By the terms of the lease this practice is restricted to inferior Forests. It appears to be essential that the compact portion of the Nachar and other superior forests, should, as soon as possible, be demarcated by boundary marks.

The terms of the lease do not prohibit the felling of trees for agricultural and domestic purposes by the inhabitants of the country; but as the forests are placed under the control of the British Government, it seems not unreasonable to suppose that, within the demarcated portion of the Nachar Forest, the cultivators will abstain from felling any trees which have not been pointed out to them by the Forest Officers.

No.	Date.	Name of Officers conducting the Survey.	Locality.	Deodar. First class above 6 ft.	Second class 4 ft to 6 ft.	Third class 1½ ft to 4 ft.	Fourth class small	Stumps.	Area surveyed. Length in ft.	Width in ft.	Area in acres.	Trees per Acre. First class.	Second class.	Remarks.
9	Sept. 17	Dr Brandis, Dr Stewart, Capt. Wood	Dippi	4	4	24	..	10	800	250	1·72	2·33	2·33	
10	„	„ ..	„	18	43	89	scarce	34	1500	250	6·89	2·61	6 97	
11	„	„ ..	„	19	43	116	middling	151	1500	250	8·61	2·21	4 99	
12	Sept. 19	„ ...	Jance Forest ...	65	47	65	330	5	3200	300	22·04	2·95	2·13	P. excelsa, 55 A. Smithiana, 46
13	„	„ ..	„ ..	33	21	65	140	3	1300	300	8·95	4·25	2·35	P. excelsa, 5 A. Smithiana, 8
14	„	„ ..	„ ..	107	93	85	500	7	2800	290	14·14	7·56	6·57	P. excelsa, 6 A. Smithiana, 7
15	Sept. 20	„ ..	Punang Forest at the head of the slide	10	23	38	120	125	1900	300	13·09	0·76	1·76	P. Excelsa, 9 A Smithiana, 6 Deodar dead, 32 A Smithiana, 7
16	„	„ ..	Punang Forest above the slide	6	17	19	90	68	1000	300	6·89	0·87	2 47	P. Excelsa, 7 A. Smithiana, 5
17	„	„ ..	Phinla Forest ..	37	34	37	110	45	1100	300	7 57	4 89	4·49	Deodar dead, 8 P. Excelsa, 2 A. Smithiana, 5
18	„	„ ..	„ .	95	69	89	150	..	1000	250	5 74	16·55	12·02	
19	„	„ ..	Phinla Forest upper portion ..	13	6	...	100	..	2900	200	10·10	1·19	0·59	

Forests between the Wangtu Bridge and the Melgad.

Nos. 9—11. *Locality.*—Near the Wangtu Bridge two streams join the Sutlej from the south, the Lower and Upper Panwigad. About two and a half miles above the bridge is a third stream, the Melgad. On both sides of the lower Panwigad near the Sutlej there is a certain quantity of Deodar, and some has been cut on the east side for the Wangtu Bridge. On the west side of the Upper Panwigad, above the village of Panwi, is a group of good sized Deodars, and above this group are a considerable number of scattered trees. The road to the Shatool Pass runs along on this side. Above the village the road passes through cultivated land, and then enters a forest composed of *P. excelsa* and *A. Smithiana*, with a very few Deodars on the out-skirts. Higher up, no Deodar is said to be found on this side. The space between the Upper Panwigad and Melgad is occupied by the end of a high ridge. The western flank of this ridge is exceedingly steep and rocky, the northern face slopes towards the Sutlej at an average angle of 40°, and presents frequent rocky precipices. Its foot along the Sutlej is a continuous mural precipice, for upwards of a mile and a half, in some places several hundred feet high. The eastern flank towards the Melgad has, upon the whole, a gentler slope. Deodar is scattered in considerable quantities over the western flank, but the trees cannot be brought to the river in the shape of logs. On the north face, the forests must, six years' ago, have been very extensive, and rich in large trees; at present the lower parts contain nothing but stumps, and a few trees of the smaller classes. Some valuable forest is said to remain over a range of cliffs at an elevation of more than 2,000 feet above the river. On the east side also from which logs can be slid to the Sutlej, a good forest remains above a precipice of rocks. This is called the Ramni Forest. Further inland, above the Melgad, some apparently good forest tracts exist, but under the present system of working they are not available. The eastern part of these is called Kusthal, the western is known by the name of Dippi Surveys 9, 10, and 11 were made in the Dippi Forest immediately below the range of cliffs mentioned before.

Soil.—The rock is granite with a scanty covering of soil on the parts examined by us.

Other trees.—*Q. incana* and *Cedrela serrata* below the Deodar Forest. The trees principally mixed with Deodar were *P. excelsa* and *A. Smithiana*, with Elm and Maple in moist localities.

Size of trees and rate of growth.—Above the village of Panwi a Deodar was measured 22 ft. in girth and 148 ft. high. In that part of the Dippi and Kusthal Forest examined by us, the average size of the trees was not very large. The rate of growth was 1st class 117, 2nd class 88 years. It must, however, be mentioned, that when examining the Ropur Depôt in November, I found that the logs said to have come from the Dippi, Kusthal, and neighbouring Forests, showed a much better rate of growth. The average results of 8 logs of average quality, of which I counted the rings at the butt end were:—

Age of 1st class trees .. ... 90 years.
Age of 2nd class trees ... ... 66 „

General Remarks.—Area. It is impossible, with the data before us, to venture upon an estimate of the area and contents of the Dippi and Kusthal Forest. Surveys 9 to 11 indicate a poor forest, and we did not visit the richer portion. The stumps were at the rate of 11 on the acre, so that before felling commenced, these low parts of the forest must have averaged upwards of 13 first class trees on one acre.

Reproduction.—In some parts of the Kusthal Forest, we observed a large proportion of seedlings, but wherever the whole of the large trees had been cut down, the ground was covered with dense low brushwood of *Abelia, Berberis, Rubus*, and other shrubs, between which no young trees could spring up.

Working.—We ascended a slide made by Mr. Aratoon. It had the appearance of having been smoothed by the passage of a large amount of timber, but was full of rocks and pieces of shattered logs. Near the river it passes over a perpendicular precipice 100 feet high, and to prevent destruction of the logs, they are only slid down when the river is in full flood Another slide by Prem Sing was similar to the above, but its passage into the river more favourable, being through an opening in the rocks over sloping ground. At the foot of this slide several thousand logs and pieces of logs were counted from the road on the opposite bank of the Sutlej. There is one main slide for the timber from the Kusthal Forest, and there are two from the eastern portion called the Rampi Forest. At the Rampi slide about 1,000 logs, and splintered fragments were counted. We learned, that nearly 5,000 trees had been felled in these forests between 1859 and 1863, *viz* :—

Panwi	...	...	...	250 Trees
Dippi	...	...	...	1,231 „
Kusthal	...	...	...	1,036 „
Rampi	...	..	...	2,400 „
Karang	...	...	..	31 „
		Total	...	4,948 „

It appears desirable that the Dippi and Kusthal Forests should have complete rest for some time, excepting the portions not yet worked. Where the forest has been worked, it is full of the tops and branches of felled trees, and many entire trees are lying on the ground. It does not appear that the Forest is regularly visited by jungle fires. No demarcation of reserved tracts is called for at present.

Forests between the Melgad and Punang-gad.

Nos. 12—14. *Locality.*—The face of the ridge between the Melgad and Punang-gad rises abruptly from the river in a precipice between 100 and 300 feet high. At an elevation of about 1,000 feet, the slope is easier. Here is the village of Janee and above it a belt of Deodar Forest, nearly a mile long, and about a fourth of a mile broad, known as the Janee Forest. The slope is steeper in the Forest than below, near the village. On the west flank of the ridge towards the Melgad, above Melang village, a large extent of apparently good Deodar Forest was seen. This on account of its distance from the Sutlej is not available at present. On the east flank facing the Punung-gad, there is also a considerable tract of Deodar.

Soil.—Granite rock is seen protruding in the Janee Forest. Between the rocks the soil is apparently rich and deep.

Other trees.—Below the Janee Forest the hill side is covered with *Quercus Ilex*. The associates of Deodar are *P. excelsa* and *A. Smithiana*. The latter is seen abundant near the top of the hill.

Rate of growth and size of trees.—The following trees were measured :—

(1) Height 115′, girth 9′5″, spread of branches 45′, both in the direction of the slope and across it.

(2) „ 47′, „ 22′, top broken. To the south-west of this tree is a large piece of ground covered with young trees.

(3) „ 130′, „ 11′6″, spread of branches 63′ across the slope, and 75′ with the slope.

The rings counted on other trees, as detailed in the Register, indicate a better rate of growth than in the Nachar Forest; the age of a first class tree being only 74, and that of a second class tree 56 years.

General Remarks.—Regarding the area and contents of the Deodar localities in the side valleys of the Melgad and Punang-gad, no estimate can be formed. The Janee may be estimated to cover 160 acres; the surveys give only a rate of five first class trees per acre, or a total of 800 trees. It is supposed that this estimate is considerably below the mark. The natural reproduction of the Forest appears to be good. Numerous seedlings of this year's growth were observed in places with much shade, but it is doubtful whether these will ever grow to any size. The proportion of seedlings, was generally good. In one part of the Forest almost every stem was scorched at the base. In the western part of this Forest about 350 trees are stated to have been cut by Mr. Arratoon, and the logs slid down. The upper part of the slide is well chosen, with a slope of 38°. Near the river it passes over a perpendicular precipice about 200 feet high; and the destruction of timber must have been very great. No rocks have been blasted, but only brushwood cut. The remainder has never been touched on account of the slight slope above, the rocks below, and the cultivation intervening. These obstacles might be overcome. It is desirable to demarcate the Janee Forest on account of its vicinity to the village. The eastern part has evidently sprung up on deserted fields of which the terrace walls remain. Survey No. 13 was made in this portion.

FORESTS BETWEEN THE PUNANG AND SDEELING STREAMS.

Nos. 15—19. *Locality.*—It appears expedient first to indicate the general position of all Forests, the survey of which is described in Nos. 15 to 25. From the road on the right bank of the Sutlej between Urni and Chergaon, a prominent object is the Badiarang Peak which rises midway between Punang and Kilba villages, at a distance of about 5 miles in a direct line from the river. From this Peak two principal spurs run to the river. The most eastern spur, which reaches the Sutlej opposite the Runang-gad is marked by a high precipice forming its north-west flank over a distance of more than three miles. The other spur is less marked, it reaches the Sutlej near the mouth of the Runang-gad, and the village and cultivation of Punang is situated on its north slope. The space between these two spurs is sub-divided by a number of minor spurs on the face and flanks of which the Deodar localities are situated as follows :—

(1). The Kulunga Forest facing the Punang-gad.—Not visited. Timber could be made available at present from this Forest only by converting it into portable scantling.

(2). The Punang Forest above the village of Punang—(Not visited).

(3). The Wachamchi and Phinla Forest on both flanks of a spur which meets the Sutlej at the mouth of the Sdeeling stream. On the west side this Forest has been much worked, but on the east flank, high up, some of the finest Deodar localities in Kunawur still remain, known as the Phinla or Sdeeling Forest.

(4). The Jumpan Forest below the Dogri of Kilba, on a spur which separates the Sdeeling and Halabgar streams.

(5). The Wasankan Forest on both sides of the Halabgar stream.—In these two Forests, 4 and 5, the size of the trees is said to approach nearer to that in the Nachar Forest than anywhere near the Sutlej.

(6). The Chokro and Jumki Forests.—The Jumki Forest occupies the face, and the Chokro the west side of the spur which divides the Kilba Valley from the Halabgar stream.

(7). The Kiuden Forest.—This joins the Chokro Forest on the spur just mentioned, and extends to the east, nearly over the entire width of the Kilba Valley, of which it occupies the upper portion. This is an extensive and very rich Forest, entirely unworked.

(8). The Kilba Forest, between the eastern main spur mentioned before, and the first secondary spur from it to the west.

The Punung and the western portion of the Phinla Forest have been worked, and are at the head of a large timber slide, which we ascended from our camp on the Sutlej River. The slide is more than a mile long, and rises at an angle of about 35°. In this part of the Forest, surveys 15 and 16 were taken. Further east the jungle has the name of Phinla Forest (surveys 17,18 and 19). It extends to the limit of Deodars at an elevation of probably 10,000 feet. No. 18 is a rich forest, which has sprung up on old fields. These, to judge by the size of the trees, must have been deserted about 200 years ago. Higher up (survey 19) the forest is a mixture of P. Webbiana, Birch, and a little Deodar.

Aspect, Slope, and Soil.—The rock is granite with a good covering of soil. The aspect of these Forests is north and north-east, and the slope is from 30°. to 35° In the upper portion of the Phinla Forest the slope is broken by the old terraces made for cultivation.

Other trees.—Besides *P. excelsa* and *A. Smithiana* there are in moist localities *Rhus*, *Alnus*, Poplar and Maple, below, and *P. Webbiana* with Birch, in the higher parts of the Forest.

Rate of growth and size of trees.—The following trees were measured :—

(1). Girth 14'6" height 117'
(2). „ 8' „ 116'

The largest trees are found on the deserted fields in the upper part of the Phinla Forest. The trees stand very close, and the stems are clear of branches to a considerable height.

General Remarks.—No estimate of the area and contents of the Punang and Wachamche Forests can be attempted. The Phinla Forests may cover upwards of 300 acres, which, at the rate of 10 first class trees per acre, would give a total of 3,000 first class trees. Our guide stated that logs could be rolled from the Punang Forest into the main river. The growth of young trees throughout these Forests is good; large numbers exist wherever trees have been removed, and a judicious arrangement of felling operations would ensure a satisfactory reproduction of the Forest. At the head of the slide in survey No. 15, 32 trees killed by fire were counted. Some of these had been burnt intentionally in forming clearings for cultivation, but the greater portion had apparently been killed by jungle-fires.

Slide from the Punang Forest.—Little has been done to improve this slide beyond rolling logs down it to the river. Several huge rocks and a large mass of smaller boulders are in the line which the logs have taken, and consequently a considerable number have been broken into two, or entirely smashed. We counted 256 half logs and pieces along the upper portion of the slide. A large quantity of shattered fragments was also lying at the foot of the slide near the river. In many instances the logs had split length-ways into two halves. A moderate expenditure in blasting rocks would have made this an excellent road for timber, and probably have saved a large proportion of the timber felled in this Forest; unfortunately it is too late now, as the greater part of the Deodar at the head of the slide has been cut down. In the Punang Forest 888 trees are said to have been felled from 1859 to 1863. To judge by the number of stumps, this part of the forest contained before working commenced 10 trees per acre.

No	Date	Name of Officers conducting the Survey	Locality	Deodar: First class above 6 ft.	Second class 4½ ft to 6 ft.	Third class 1½ ft to 4½ ft	Fourth class small.	Stumps.	Area surveyed: Length in ft.	Width in ft.	Area in acres.	Trees per acre: First class.	Second class.	Remarks
20	Sept 20	Dr Brandis, Dr Stewart, Capt E Wood	Wasankan Forest	40	26	25	150	1	500	250	2·87	13·94	9·23	P excelsa, 5 A Smithiana, 3
21	„	„	Chokro Forest ..	23	17	43	80	3·5	3600	250	20·66	1·11	0·82	A Smithiana, 3
22	Sept 21	„	Kiuden Forest ...	83	75	18	150	9	1100	200	5·05	16·4	14·8	Deodar dead, 3 P excelsa 4
23	„	„	„ ...	19	11	...	...	..	...	..	0·33	58·0	33·3	
24	„	„	„ ...	57	33	21	120	7	350	200	1·6	35·6	20·6	Dead 36 Fallen 4 P excelsa 1st class, 2 „ 2nd „ 7 „ 3rd „ 3
25	„	„	„ ...	35	27	8	170	...	1000	250	5·74	6·10	10·00	P excelsa, 8. A Smithiana, 7
26	Sept 21	„	Kilba Forest ...	22	71	193	...	115	2600	300	17·92	1·23	3·96	P excelsa A Smithiana, 3 Logs not removed
27	Sept 22	Dr. Brandis ..	Kunai Forest Kumkumee Forest	No regular survey.								Stumps and burnt trees.		
				Burnt										
			Rapung Forest ..	71	...	...	...	410	1600	400	14·99	32·74		

FORESTS ON BOTH SIDES OF THE HALABGAR STREAM.

Nos. 20 and 21. *Locality.*—The road from the pastures at the head of the Sdeeling River to Kilba village, first crosses several of the feeders of this stream near the limits of arborescent vegetation. It then descends on a gentle slope over fields and open pastures, belonging to the Dogri of Kilba, towards the Halabgar stream. On the spur between this stream and the Sdeeling is the Jumpan Forest. It commences immediately below the fields, and extends to within a short distance of the Sutlej. This is one of the richest forests remaining on the Sutlej, stated to have been protected by the rocky state of the ground, rendering the removal of timber difficult. We visited only the upper end of the forest, and found the size and growth of the trees magnificent. The forest east of the Halabgar stream is broken up into a number of distinct forest tracts, situated between the Halabgar stream and a sharp ridge of quartz rock, which divides the stream from the amphitheatre, in which the Forests and fields of Kilba are situated. Along the west flank of this ridge the lower portion is known as the Chokro Forest. The upper portion near the stream is more compact, and in this survey No. 20 was taken. It is called Wasankan Forest. Below the Chokro Forest on the triangular head of the spur is a small tract called Jumki. From this locality Mr. Aratoon is said to have removed 15 trees.

Soil, &c.—Granite rock with good soil in the Wasankan, with a slope of 30°, and a north north-west aspect, and poor quartz rock in the Chokro Forest.

Rate of growth, size of trees, and reproduction.—According to the data collected, the rate of growth in the Wasankan Forest is slow, the age of a first class tree 6 feet in girth, varying from 152 to 181 years. The first class trees seen in the Wasankan Forest were mostly of good size; one was measured 9 feet 4 inches in girth, and 135 feet high the proportion of young trees was satisfactory, wherever there was sufficient light to enable them to spring up.

General Remarks.—The lower part of the Chokro Forest has been much worked lately; it should now be left alone. The trees which remain are too much scattered to admit of further felling without destroying the forest; but the Jumpan and Wasankan Forest might be worked at once; some expense would be necessary for making timber slides to the river. The slides by which the timber has been removed from the Chokro Forest are apparently nothing but the slope of the hill, somewhat smoothed by the gliding down of the logs. Two hundred trees are said to have been cut in this part by Mr. Aratoon, and 200 logs sent down. The slides, where we saw them were the bare rock, a little smoothed by the passage of the logs, and without trace of any labour bestowed upon them. To judge from general appearances, the contents of the forests on both banks of the Halabgar stream, *viz.*, Jumpan, Wasankan, and Chokro, may be assumed to be about equal to those of the Phinla Forests.

KIUDEN FOREST.

Nos. 22—25. *Locality.*—The Kiuden Forest is situated above the village of Kilba on a large extent of deserted fields, of which the terrace walls are still standing. It joins the eastern portion of the Chokro Forest, and its area may be estimated at 300 acres; it is one of the best and most compact forests that we have examined, and second only to Nachar.

Soil, slope, aspect, &c.—The rock is quartzose, but the soil is rich from being terraced, and from having been enriched by the accumulation of vegetable matter for centuries. The slope has a northern aspect, and is from 23° to 35° where there are no terraces.

Other trees.—Quercus Ilex, and Pinus Gerardiana are common between the village and the forest.

Rate of growth, size, and reproduction.—The trees in this forest are of large size, the stems are clear of branches, and do not lose in girth much. The following trees were measured :—

(1) Girth 3'3", age 84 years
(2) „ 5'4", „ 149 „
(3) „ 13'0", height 145 feet

These, trees, however, were not fair specimens of the rate of growth. The first was measured on poor rocky soil below the forest; the second was the stump of a tree that had grown oppressed by the other trees, 60 feet of the stem of first class trees may, in this Forest, be considered available for timber, and the mean girth for this length is about $\frac{8}{10}$ of the butt girth.

The quantity of timber standing on an acre is large ; on one-third of an acre along one of the old terraces 19 trees of the first class, and 11 of the second were measured with an aggregate cubic contents of 2,933 feet, which gives 8,971 cubic feet per acre. The average contents of a first class tree was 142, and of a second and third class tree 22 cubic feet. In another locality the trees of different classes were counted on an area of 350′ × 200′, with the following result :—

First class trees 57, cubic content, 8,094 cubic feet.
Second „ 33, „ 726 „
Total ... 8,820 „ on 1·60 acre, or 5,512 cubic feet per acre.

The average age of the first class trees from 6 to 10 feet in girth may be assumed at about 180 years. This would give an average annual timber production per acre up to date, of 50 cubic feet in the first, and 31 in the second locality, not taking into account tops and branches, and the trees which have died as the forest grew up.

Assuming the average number of first class trees per acre to be 20, this would give for the Kiuden Forest about 6,000 first class trees. This is, we believe, a moderate estimate. The growth of young trees is good ; wherever light was given by the death or fall of large trees, seedlings had sprung up in abundance. There was in the Forest a clearance of about 150 feet broad, and several hundred feet long, down the slope. This was covered with young trees. The attempt might here be made with success to clear alternate strips, from 100 to 200 feet wide, of all first class trees that will yield marketable timber, leaving the forest on both sides intact, and likewise a belt of forest above, at the top.

General Remarks.—The forest has been protected by the fields of Kilba intervening between it and the river, the owners of which would have to be compensated in case slides were made. There seems to be no physical obstacle against the removal of the timber.

Kilba Forest.

No. 26. *Locality.*—A high and precipitous wall of quartzose rock bounds the valley, in which the fields and village of Kilba are situated, to the east. After ascending this ridge we found that towards the east side it slopes more gradually, the strata of the rock having a northerly strike and a dip to the east. The valley between this ridge and the main spur mentioned above, is drained by a small stream which joins the Sutlej below the mouth of the Runang-gad. Before working commenced, a good Deodar Forest appears to have covered the slopes of this valley. But now, excepting the upper part, it may almost be called a Forest of stumps. We proceeded downwards along the crest of the ridge, and then descended to the bed of the little stream mentioned above, which is used as a slide with several branch slides.

Soil, slope, and aspect.—In the upper part of the Forest there is little soil on the quartz rock, and the growth of the trees is poor ; the greater portion of the third class trees counted, were stunted trees, found along the crest of the ridge. Lower down the soil appears to be favourable. The slope is about 35°, and the aspect of the portion surveyed is N. N. E.

Other trees.—Above *A Smithiana* is almost the only tree mixed with Deodar ; lower down *Quercus Ilex* is abundant. One tree measured 6'10" in girth, with a clear stem 20′ long.

Rate of growth, size, and reproduction.—The following trees were measured.—

The detail of the trees examined is given in Appendix III, No. 9, the result is 138 years for the age of a tree 6′ in girth, and 100 for a tree in girth 4 feet 6 inches. This is slow growth. The young trees of the fourth class were not counted, but their number was very large.

General Remarks.—1,202 trees are stated to have been felled in this forest in 1859 and 1863 That portion which was surveyed, has principally been worked by Mr. Aratoon. The work has not apparently been conducted in a careful manner. In the upper part of the Forest large numbers of trees were felled, but hardly any removed. Out of 115 trees felled, of which the stumps were counted, 32 had been left lying on the ground untouched. These had been

lying on the ground for several years; some had been injured by fires, and all are likely to suffer from decay of the sapwood before they are removed. If it is at all intended to husband the timber resources of these Forests, some steps will have to be taken to compel the owners of timber remaining within them, to remove it without further delay.

Slides.—We crossed several slides, and examined particularly that slide which follows the bed of the torrent above described. As the water of this stream is required by the inhabitants of Kilba for the irrigation of their fields, a channel across the slide had been made, and bridged over with rough stones, so as to enable the logs to pass over it without injury to irrigation. The bed of the torrent was full of large boulders of rock and debris of logs, showing that a proportion of the timber had been injured or destroyed in their passage downwards. It was stated by our guides that 1,000 trees had been felled in this forest. To judge by the number of stumps counted, the portion surveyed must have contained upwards of seven first class trees per acre. Now it only contains one per acre on an average; and should the mass of dry trees and branches with which the ground is now covered catch fire, trees still standing would be entirely destroyed, the ground would be covered with shrubs, and the reproduction of the Forest would seriously be endangered. If practicable, a short time should be fixed for the removal of the timber from this Forest, and if this is not done by the date fixed, it would have to be removed by the Forest Department. The tops and branches of the trees which cannot be utilized, should then be collected in heaps and destroyed by fire, so as to give the young trees a fair chance to spring up. Otherwise the forest should be left alone, and its contents cannot be reckoned as part of the resources immediately available.

Kunai and Sapni Forests.

No. 27. *Locality.*—Between the spur, which, as described before, bounds the Kilba Forest to the east, and another spur which runs from it to the junction of the Buspa and Sutlej Rivers, the village and Forest of Kunai is situated. The most compact portion of this Forest is on the east slope of the ridge above the road from Kilba to Kunai, The portion below the road has been extensively worked by Mr. Aratoon. On the west side of the spur which runs towards the junction of the Buspa and Sutlej, and divides Kunai from Sapni, is the Kumkumee, and on the east is the Sapni or Rapung Forest. At the top, near the upper road from Sapni to Kunai, these two Forest tracts join. There is a lower road through these Forests.

Lower part of the Forest destroyed.—A part of Kumkumee Forest and the entire Sapni Forest below this road have been destroyed by fire. It was stated by my guides, and confirmed by Mr. Aratoon's Agent, that a few years ago, after the trees in these Forests had been felled, a portion only was removed, and the greater part of the trees was left lying on the ground. In two successive seasons fire entered the Forest, destroyed all timber felled, and killed the standing trees. In the Sapni Forest, I counted on a length of 1,000 feet along the lower road, 410 stumps of large trees, all charred or half-burnt, and 71 first class trees standing but killed, besides the remains of a large number of trees of the smaller class all killed by the fire. No young trees had sprung up; the ground was naked and barren, and will probably remain so or produce low scrub only. Calculating the number of stumps and killed first class trees per acre, we obtain 32·74 first class trees per acre on the ground surveyed before the Forest was destroyed. This lower part of the Sapni Forest must have been one of the finest Forests on the Sutlej before it was burnt. The area of the forest thus destroyed measured probably more than 100 acres It is reported that 250 trees were felled in the Kunai, and 447 trees in the Sapni Forest between 1859 and 1863. The latter statement regarding the Sapni Forest must be considerably below the number actually felled, as the stumps counted on a small portion alone amounted to 410.

Forests still remaining.—The compact portion of the Kunai Forest, and what remains of the two others, may be estimated to cover about 200 acres. In the Kumkumee Forest along the upper road, I estimated the first class Deodar trees at 10 per acre with about two additional of *A. Smithiana*, and a few *P. excelsa*. The Sapni Forests are much richer; there appeared to be upwards of 15 first class trees on the acre. The soil in these two forests is very rich, the rock being a gneissoid granite. Assuming 10 trees per acre, the number of first class trees remaining in these three Forests may be estimated at 2,000.

Size of trees and rate of growth.—The following trees were measured:—

Kumkumee Forest	(1)	tree, girth	10′0″	height	150′		
,,	(2)	,, ,,	18′0″	,,	150′		
,,	(3)	stump ,,	9′9″	,,	—,	rings	170
Sapni Forest	(4)	,, ,,	24′0′	,,	—,	,,	
,,	(5)	,, ,,	12′0″	,,	—,	,,	176
,,	(6)	,, ,,	7′6″	,,	—,	,,	120

These indicate an age of 90 years for 6′ and 65 years for 4′ 6″ in girth.

Near the Kunai Forest, round a temple, six gigantic trees stand on an area of 100′ by 100′ or about one-fourth of an acre. Four of these were measured, and had the following girths at 6′ from the ground:—

25′4″, 24′9″, 23′2″, 17′4″.

The age of the largest of these trees cannot be less than 600 years.

Future management.—It appears desirable to demarcate the remaining portions of the three Forests here described, and thus to secure their effectual preservation.

No.	Date.	Name of Officers conducting the Survey.	Locality.	Deodar. First class above 6 ft.	Second class 4½ ft to 6 ft.	Third class 1½ ft to 4 ft.	Fourth class small.	Stumps.	Area surveyed. Length in ft.	Width in ft.	Area in acres.	Trees per Acre. First class	Second class.	Remarks.
28	Sept 12 2	Dr Stewart ... Capt Wood ...	Churi Forest .	19	14	13	47	...	1000	200	4·59	6·11	3·05	P, excelsa, 18 A, Smithiana, 61
29	„	„ ...	„ .	13	13	20	31	.	350	200	1·60	7·50	8·12	
30	„	„ ..	Buru Forest ..	42	38	28	16	...	1200	250	6·89	6·09	5·52	P, excelsa, 5 A, Smithiana, 170
31	„	„ ..	„	75	102	120	123	...	2300	250	13·20	5·68	7·73	P, excelsa, 5 A, Smithiana, 22
32	„	Dr Brandis . Dr Stewart .. Capt. Wood	Rapur Forest .	29	23	49	36	21	1100	200	5·05	5·74	4·55	P, excelsa, 8 A, Smithiana, 1
33	„	„	Jungari Forest ..	10	17	37	33	47	700	200	3·21	3·12	5·30	A, Smithiana, 1
34	„	„ ...	„ .	42	68	130	83	...	1000	200	4·59	9·15	14·81	
35	„	„ .	Shoang Forest ...	40	50	91	192	41	1700	200	7·80	5·13	6·41	P, excelsa, 5 A, Smithiana, 8
36	Sept 23	... ..	Chasoo Forest Chidu „ . Limsantang „ .	No regular surveys.										
37	Sept 26	„ ...	Serincho Forest of Sangla .	7	22	21	8	27	1100	300	7·57	0·92	2·91	
38	„	„ ..	Do. do. ..	7	23	100	142	76	2000	200	9·18	0·76	2·50	
39	„	„ ...	Do. do. ...	1	4	29	4	11	700	200	3·21	0·31	1 24	
40	„	„ ...	Rakcham Forests	22	17	37	86	16	300	200	1·38	15·94	12·32	
41	„	„ .	Yak Bursari ..	30	58	133	many	44	3000	300	20·66	1·45	2 80	

Forests between the Sapni and Buru Stream.

Nos. 28—31. *Locality.*—Between Sapni and Buru garang, up which leads the road to the Buru or Borenda Pass, are two streams, the Rapang-gad and another stream which passes the village of Batoring on its way to the Buspa. The Churi Forest is on the spur which divides these two streams, above the road from Sapni to Shoang; the Buru Forest is on both sides of the Batoring stream, but principally on the side towards Buru, the lower portion on the right bank of the stream is called Batoring Forest. Besides these, some patches of Deodar producing forest were observed south-west of the village of Buru, which were not visited.

Soil, Slope, and Aspect.—In the Churi Forest the aspect is north, the slope 35° and the soil fair. In a portion of the Buru Forest (No. 30), the Deodar grows on deserted fields, and here the forest is best, the slope is 35° and the aspect north and north-east.

Rate of growth, size of trees, and reproduction.—In the Batoring Forest near the road, the average size of the first class trees is girth 10′ to 12′, height 150′. In the Buru Forest one tree was measured, girth 6′ 4″, rings 104. The other trees of the first class averaged about the same size. It is supposed that the trees in the Churi Forest would yield, on the average, 3 logs of 12 feet each, and that the trees in the Buru Forest will, if any thing, yield a greater length of marketable log. Assuming the area to be 120 acres, containing 5 first class trees on an acre, these two forests contain 600 first class trees. 485 trees are reported to have been felled in the Buru Forests between 1860 and 1862. The only person who has felled timber in the Buspa valley above the village of Buru, is Mr. Aratoon.

Forests between the Buru Stream and Shoang.

Nos. 32—35. *Locality.*—Between the Buru garang and Shoang village is a broad rocky shoulder, about 1½ mile wide. The road from Buru to Shoang village leads along the hill-side, which has a north-east aspect and a slope of 35°. In many places there is but little soil on the rock, which is distinctly stratified; and parts of the hill are perfectly bare of trees. These barren slopes separate the four belts of forest in which the survey was made. The line was taken along the road.

Rate of growth, &c.—The following trees were measured. From the trees examined in this forest and entered in No. 13 of the Register in Appendix III, it would appear that the average age of first and second class trees in this forest tract is about 91 years for a girth of 6′, and 66 years for a girth of 4′ 6″.

These forests have been worked extensively by Mr. Aratoon. 1,021 trees are reported to have been felled between 1859 and 1863. Five slides were observed, *viz*, tracks where a suitably situated slope of the hill had been smoothed by sending timber down to the river. The total number of first class trees counted on 20.65 acres in these forests was 121, the total number of stumps 109, this gives an average of 11 first class trees per acre before the working was commenced, of which about one-half have been removed. The total area may be about 300 acres, still containing upwards of 1,500 first class trees.

Future management.—These forests should have rest; for some time no trees should be felled. Demarcation does not seem to be called for, as there appears to be no ground to apprehend injury from cultivation at present.

Forests between Shoang and Sangla.

No. 36. *Locality.*—Between Shoang village and Sangla on the left side of the Buspa, Deodar is scattered on the lower slopes of the hills. According to Gerard, the elevation of Sangla is 8,568 feet. The tree hardly exceeds an elevation of 9,500 feet in the Buspa valley. Chasoo is 9,174 feet, and a few hundred feet above the village Deodar ceases, and *Pinus excelsa*, Birch, and Picea Webbiana take its place, and carry arborescent vegetation about 2,000 feet higher up. Four distinct Deodar tracts may be considered :—

(1).—A considerable number of Deodar trees is on the west slope of a rocky precipice which skirts the Supoorts Garang, the stream between Shoang and Chasoo. This precipice has a broad step about 300 yards wide, drained by a small ravine which joins the Buspa River below a Dogri of Chasoo village. This ravine has been used as a slide by Mr. Aratoon. It has a gentle slope, and is altogether a favourable locality; but the slide has not been improved by blasting or otherwise. Some Deodar is also on a ledge of the rock which projects to the north.

(2).—The left bank of the Buspa River is high and steep, from the mouth of the Supoorts Garang to the gorge where the river leaves the flat of Sangla; between these two points the river runs over a succession of falls and rapids. This high and steep bank is covered with Deodar and a few trees of *A Smithiana*; and a number of trees have been felled here by Mr. Aratoon.

(3).—On the left bank of the Buspa river, above the gorge described. Here the hills approach the river, and were formerly covered with a fair Deodar Forest; a small number of trees only is left at present, the greater portion of the larger trees having been cut down. This forest is called the Chidu Forest.

(4).—Opposite Sangla is a small Forest of Deodar, on the north face of a hill. This is called the Limsantang Forest, and has not been worked. It is said that the villagers would not allow trees to be felled.

Rate of growth and size of trees.—The figures given in Nos. 14, 15, 16 of the separate Register in Appendix III give an average age of 72 years at 6′ girth, and of 53 years at 4′ 6″ girth. One tree growing between the precipice and the Supoorts Garang measured girth : 16′ 6″ height 145′.

Future management.—The only forest of the four here described, that appears to call for demarcation, is that opposite Sangla. It is considered sacred, and the trees are cut only for temples and other sacred buildings. The question may, therefore, be raised whether this forest can, with propriety, be demarcated. No survey was made of these different Forest tracts; but the aggregate area does not probably exceed 200 acres, and the Forests are not likely to contain at present more than 1,000 first class trees. It is reported that 551 trees were felled by Mr. Aratoon between 1859 and 1862, in the Chasoo Forest.

Serinche Forests.

Nos. 37—39. *Locality.*—The highest forests of importance on the right side of the Buspa River are opposite the village of Bursari, and below the Dogri of Serinche, between the river and the steep cliffs, which bound the valley on this side. The width of the Forest nowhere exceeds half a mile, and is commonly much less.

Soil, Slope, and Aspect.—The ground along the river is covered with blocks of granite, and there is apparently little soil between them. The slope is steep near the river and gentle higher up.

Rate of growth and size.—The following trees were measured :—

No.	(1)	girth	7′	7″	rings	68	No.	(8)	girth	10′ 6″	rings 89
,,	(2)	,,	7′	9″	,,	65	,,	(9)	,,	12′ 4″	,, 147
,,	(3)	,,	6′	5″	,,	65	,,	(10)	,,	7′ 5″	,, 200
,,	(4)	,,	7′	6″	,,	67	,,	(11)	,,	7′ 2″	,, 144
,,	(5)	,,	6′	10″	,,	66	,,	(12)	,,	5′ 9″	,, 97
,,	(6)	,,	6′	10″	,,	93	,,	(13)	,,	8′ 8″	,, 217
,,	(7)	,,	11′	9″	,,	142	,,	(14)	,,	5′ 3″	,, 89

The trees numbered 1 to 9 and 12, had grown on a gentle slope of about 10°. Nos. 10 to 14 stood on a steep slope of 30° with a south aspect. The rock in all instances was granite. These figures confirm the result of observations in other parts of Kunawur, tending to show that, on a gentle slope, the rate of growth is commonly better than on a slope of a steep gradient. These figures indicate for the trees on an easy slope an average age of 44 years

for 4′ 6″ girth, and of 62 for 6′ 0″ girth. For the other trees the corresponding ages are 98 and 132. The rate at which the stem diminishes in girth towards the top appears from the following figures:—

Girth at	2′	11′9″	Rings 142
„ at	52′	5′0″	„ 100
„ at	3′	10′6″	„ 89
„ at	53′	4′2″	„
„ at	64′	3′0″	„ 47

The trees in this Forest are not generally very large. The first class trees left standing are mostly under 10′ in girth and under 80′ in height, the largest tree measured had a girth of 17′ 10″, and was 105′ high. The size of the stumps shows that formerly the Forest produced larger timbers. It is stated that the greater number of trees only produced 2 logs each.

General Remarks.—The number of young trees in suitable localities is favourable. 347 trees are reported to have been felled in this Forest. 114 stumps were counted, and of these 20 trees had not been removed. Not more than a few hundred first class trees are left standing on the ground.

Rakcham Forest.

No. 40. *Locality.*—This Forest is on the right bank of the Buspa, on an island formed by this river and the Runalgad, a considerable torrent which is fed by one of the glaciers of the Raldang Range. This stream, before its junction with the Buspa, divides into a number of branches, the principal one of which runs for about a mile parallel to the Buspa River through a flat above the village of Bursari. The Forest consists of two patches; the survey was taken in the upper one.

Soil, &c.—The ground is covered with granite boulders. The soil is very sandy.

Rate of growth and size.—The following trees were measured:—

(1.)	Girth	9′0″	Height	100′
(2.)	„	8′5″	rings	130
(3.)	„	7′7″	„	136
(4.)	„	7′8″	„	196

The trees are of good height and well proportioned. The two patches mentioned may contain upwards of 100 first class trees. The rate of growth is slow, though the ground is level It is believed, that the soil is poor and water-logged.

Observations on the limit of Deodars in the Buspa valley.—Between the flat above Sangla and the village of Rakcham, there are two distinct steps in the valley; in each the ascent is over a mass of granite boulders. These granite boulders fill up the valley from one side to the other, and may possibly be the remains of large terminal moraines of a glacier, which at some remote period filled the upper part of the Buspa valley. Scattered Deodar trees are found at the foot of the first or upper old Moraine on the right or north bank of the river. According to Gerard, the elevation of Sangla is 8,568′, and of Rakcham 10,456′ Hence the upper limit of Deodar in this part of the Buspa valley, may be assumed to be about 10,000′.

Yak Bursari Forests.

No. 41. *Locality.*—On the left bank of the Buspa River, between the Rupti-gad opposite Sangla and the first step or old Moraine above the village of Bursari, the lower slopes of the hills and the steep banks of the river are more or less covered with Deodar. The tract between the Rupti and Hurba-gad is known under the name of Hurba Forest; the remainder is called below Ek-Bursari Forest, and above Burra Bursari. The survey was conducted from the bridge below Bursari village downwards, on flat terraces above the river.

Soil, &c.—The Forest is on tolerably flat terraces along the margin of the river, becoming steep and rocky some hundred yards off. The soil of the lower part is fair. The rock observed was granite; the slope varies.

Rate of growth, size, &c.—The following, trees were measured:—

(1)	Stump girth	7′ 2,″	rings	115.
(2)	„ „	5′ 2,″	„	91.
(3)	„ „	4′ 2,″	„	101.

The trees were well grown and of good height.

General Remarks.—These Forests were worked by Mr. Arratoon about 4 years ago. In accessible portions, a considerable proportion of the large sized trees has been cut down. Opposite the bridge were found 38 logs cut by Mr. Arratoon 4 years ago, and which had been left lying. Some of these logs were partially decayed. A considerable tract of the Forest had been completely destroyed by an avalanche. The trees had been thrown down and are lying on the ground. No young trees had sprung up in the tract thus destroyed. Mr. Arratoon is stated to have felled 456 trees in the Bursari Forest; but of this, and of the timber cut by him in other parts of the valley above the gorge near Chasoo, a considerable proportion is still lying in various places along the Buspa River, having been deposited there by high floods. On the sands above the gorge we counted above 100 logs lying within a small space, which, with very small outlay, might be rolled into the river. The Forests on the left side of the Buspa River above Sangla, still contain a considerable quantity of Deodar, covering probably several hundred acres.

No.	Date.	Names of Officers conducting the Survey.	Locality.	Deodar. First class above 6 ft.	Second class 4½ ft. to 6 ft.	Third class 1½ ft. to 4½ ft.	Fourth class, small.	Stumps.	Area surveyed. Length in ft.	Width in ft.	Area in acres.	Trees per Acre. First class.	Second class.	Remarks.
42	Oct. 7 and Sept. 22	Dr. Brandis / Dr. Stewart / Capt. McWood	Ralli and Karcham Forest ..	No regular survey										
43	Sept 26	.. ...	Mebar Forest ...	12	36	120	92	8	800	200	3·67	5·78	98·1	
44	..	.. ...	.. ...	96	26	110	20	...	900	300	4·13	6·78	6·29	Dead, 37
45	..	.. ...	.. ...	60	90	90	68	8	1,200	300	8·26	7·26	10·90	Dead, 33
46	..	.. ...	.. ...	48	11	82	25	7	800	300	5·51	6·71	2·00	A Smithiana, 1 Dead, 11
47	..	.. ...	.. ..	30	33	73	36	46	1,900	200	8·72	3·44	3·78	A Smithiana, 2 Dead, 6
48	..	.. ..	Barung Forest ...	136	136	97	46	12	9,700	360	18·59	7·31	7·31	A Smithiana, 21 P Excelsa, 6 Dead, 19
49	..	... ...	Tanglin Forest ...	No survey										
50	..	Dr. Stewart ... / Dr. Brandis ..	Stalimpi	77	96	70	300	0	1,800	300	12·40	6·21	2·10	P Gerardiana (first Class), 25

Ralli and Karcham Forests.

No. 42. *Remarks.*—These Forests face the Sutlej and Buspa Rivers immediately above their junction. They were not surveyed, but as the roads from Rogi to the Runang, and from Sapni to Buru lead on the opposite sides of the Buspa and Sutlej valleys, and within an average distance, as the crow flies, of not more than 2 miles from these Forests, we had a good opportunity of forming a general idea of the extent of these Deodar localities.

Locality.—The spur which runs down from the mountain, the shoulder of which is crossed by the Harang Pass, to the junction of the Buspa and Sutlej Rivers, is well clothed with Forest on the side towards the Sutlej. These Forests, as far as Mebar village, are called the Ralli Forests from a village on the banks of the river. The slope is apparently steep. The aspect is northerly, Deodar covers a considerable area in the middle of the slope, interrupted only by a few ravines, precipices of rock and narrow barren belts. Above it is Birch, *P. Webbiana and P. excelsa*, and below a Forest of *P. Gerardiana* and *Quercus Ilex*. There are two slides from these Forests to the Sutlej, but a portion of the Forest is stated never to have been worked, because protected by precipices below.

On the side towards the Buspa there is an open grassy slope below, above which there are several extensive tracts which at one time were covered with Deodar. These are called the Karcham Forests. They may be said to extend to nearly opposite Būrū village. Above this as far as Sangla, there are but scattered trees on this side of the Buspa River. Three slides lead from these Forests to the Buspa River. The Forests have been worked, and 179 trees are reported to have been felled in 1859 and 1863. In the Ralli Forests 306 trees are reported to have been felled during the same period.

Mebar Forests.

Nos. 43—47. *Locality.*—From the village of Mebar to Barung, the left bank of the Sutlej is lined by a range of precipitous and high cliffs. Above these cliffs is a series of good Deodar localities, which have been worked in one place only, and have otherwise been protected by these rocks. The western part of this Forest is called Mebar, the eastern Barung. In the Mebar Forest the survey went first through the Forest below the village into a small ravine to the east (43); thence across the ravine to the edge of the precipice (44); and at last upwards to the road from Mebar to Barung and along this road (45, 46, 47).

Soil, Aspect, Slope, &c.—The rock is a grey schist, sometimes morelike clay-slate, sometimes more quartzose. The strike of the strata is from north to south, and the dip eastward. Nos. 43 and 44, aspect north, slope 35°, soil good, and some old cultivation terraces—in part. The stumps are from Zemindars felling. Nos. 45 and 46, nearly as before, slope 38,° rock schistose, with fair amount of soil, and old cultivation on lower part. No. 47, very rocky, and with but little soil, slope 38.°

Rate of growth, size, &c.—The trees are well shaped, but not very tall. The first class trees are about 80′ high. The largest tree measured was below Mebar village; girth 18′ 4″, height 135′, two others measured girth 9′ 4,″ height 80,′ girth 10′, height 85′, most large trees are

branched to near the ground. The rate of growth is fair The following trees were measured :—

Girth	8′ 4″	rings	129
,,	8′ 0″	,,	183
,,	6′ 7″	,,	152
,,	6′ 4″	,,	165
,,	7′ 0″	,,	172
,,	9′ 0″	,,	180
,,	7′ 8″	,,	155

These figures give 113 years for a girth of 6′, and 83 years for a girth of 4′ 6″, 181 trees are reported to have been felled by Soda Sing in the Mebar Forests at the locality indicated above.

Barung Forest.

No. 48. *Locality.*—The Forest tract of which the survey is given, is a continuation of the Mebar Forest; there appears to be no sharp geographical division between them. The survey followed the road from Mebar to Barung. The high precipice along the river continues to the village of Barung. Above this village the Shaen-garang joins the Sutlej. On the left side of this stream there are several Deodar localities which were not surveyed. From these the timber cannot be rolled into the main river. They would however be available in case arrangements could be made to bring down sawn timber.

Soil, slope, and aspect.—The rock is a hard quartzose schist with a considerable quantity of Mica. The slope is gentle, about 20°. Where the trees are growing, the aspect is north-east.

Rate of growth, size, &c.—The trees are branched to the ground, but well shaped and of fair size. One tree 16′-6″ in girth was 90′ high. The area of the Mebar and Barung Forests covers upwards of 350 acres, and may be estimated to contain about 2,500 first class trees. A small quantity of timber only is said to have been felled in the Barung Forests.

Tanglin Forest.

No. 49. *Locality, &c.*—Between the Shaen-gad and the Tanglin-gad, a steep face of hill, about one mile broad, slopes like a large triangle from the top of one of the spurs of the Raldang mountains. A large portion of this slope, the area of which may be estimated at about two-thirds of a square mile, was formerly covered with good Deodar Forest, and in localities not easily worked, a large number of good trees are said still to remain standing. We were prevented by want of time from surveying this Forest; but to judge of what can be seen at a distance, we believe that a considerable quantity of timber remains available. This Forest is stated to have been extensively worked by Mr. Arratoon before 1862, and by Kan Sing and others after that time. This Forest together with the neighbouring Forests was given as a Jagheer by the late Rajah to the father of Surjeet, Wazir of Poari. The boundaries are the Shaen-garang below, and Kibar Dogri near Purbani above. It is stated that in the whole extent of these Forests, 3,052 trees were felled between 1861 and 1864.

Stalimpi Forest.

No. 50. *Locality.*—Between the Tanglin-gad and the village of Poari, one of the spurs of the Jastangrang peak rises into a cone shaped hill. The lower part of this hill towards the river and the Dogris of Tanglin and Skangrang is composed of detritus of granite, intermixed with granite boulders. The back of the hill and the neck which join it to the main range is composed of a stratified quartzose rock. The lower part of the hill is covered with *P. Gerardiana*, but on the back and on the upper part of the slope from the neck towards Poari village, there is a fine Deodar Forest, called the Stalimpi Forest. Higher up the trees stand on a gentle grassy slope with a north-west aspect. Lower down the ground is covered with large granite boulders; here *P. Gerardiana* commences; and further down towards the river no Deodar is to be seen. We ascended the back of the hill from Skangrang Dogri, and the trees were counted in descending over the neck described towards the village of Poari. A considerable quantity of Deodar was also observed on a separate spur to the south-east, separated from the hill just described by a small stream, which waters the gardens and fields of Skangrang. This part of the Forest could only be worked if the timber were sawn up into scantling and carried over land to the river. It was not visited.

Rate of growth, size, &c.—The size of the trees in the Stalimpi Forest is very good; one tree was measured with a girth of 18′-9″. The Stalimpi Forest may be assumed to cover 150 acres with upwards of 1,000 first class trees. It seems to have been protected by the boulders in its lower part, and its distance from the river; but there is no apparent reason why a timber-slide might not be made; some outlay would have to be incurred. This Forest like the next is said to belong to Wazir Surjeet Sing of Poari.

No.	Date.	Names of Officers conducting the survey.	Locality.	Deodar. First class above 6 ft.	Second class 4½ ft to 6 ft.	Third class 1½ ft to 4½ ft.	Fourth class, small	Stumps.	Area surveyed. Length in ft.	Width in ft.	Area in acres.	Trees per Acre. First class.	Second class.	Remarks.
51	Sept. 30	Dr. Stewart . Capt. Wood	Shunalang of Poari	20	39	56	25	31	650	300	5·85	3·42	6·67	Dead, 6 P Gerardiana, 8
52	"	"	Shunalang and on to Kanun ki ...	9	50	56	21	5	1300	300	8·95	1·00	5·59	Dead 0 P Gerardiana, 5
53	"	"	Kanun ki to east	11	33	16	16	22	1600	250	9·18	1·19	3·59	Dead 12 P Gerardiana, 16
54	"	"	Shangrang or Shanang	36	57	60	48	..	800	250	4·59	7·84	12·42	P Gerardiana, 7 P. Excelsa, 10

FORESTS BETWEEN POARI AND PURBANI.

No. 51.—Stumps almost all of this year, Slope 38°; aspect, north western; soil good on schistose rock with mica. Average of 1st class trees yield 3 logs at most.

No. 52.—One small patch of young trees burned up, otherwise as No. 51.

No. 53.—Very steep, 45°, and rocky. Soil poor. Trees not likely to yield more than 1½ to 2 logs; otherwise as before.

No. 54.—Slope 40°. Fair soil on rock, the same as that of Barung Forests. First class trees average nearly 4 logs.

Locality, &c.—These forests, which range from 8,000 feet to nearly 10,000 feet above the sea, are situated partly on the steep slope above the mountain bay, in which the village of Poari lies, and partly on the precipitous rocky face to the north. The former have been largely worked, but owing to the difficulties of the ground, &c., the latter are still intact. The lower part of the slopes is clothed with *Pinus Gerardiana*, above which the *Deodar* extends nearly to the precipitous cliffs which here crest the mountain. Surveys 51-53 were made across, and near the two chief timber slides (Shunālang and Kanunki), and indicate the present character of the forest where felling has been largely carried on. Survey 54 was made across that part where there has not been systematic felling, and which, indeed, is by no means so rich in trees as the former has been.

Aspect, &c.—The aspect of these forests varies from north-west to west. The slope from 38° to 45°. The soil is good and in fair quantity towards the south and north, but poor and scanty in the central steeper part, where the rock, a hard grey schist with mica, crops out abundantly. There are no traces of old cultivation terraces in any part.

Character of the Forest.—The trees are mostly Deodar, with a small proportion of *P. Gerardiana* intermixed, and a few *P. excelsa* towards the north where the track of the survey reached a greater elevation. The Deodar trees are of symmetrical shape, but of no great size; those of the first class towards the south and north yielding only 3 logs and occasionally 4, while the first class trees remaining in the central steeper and barer portion (near Kanunki) do not average more than 1½ to 2 logs. The proportion of dead trees is not large, but there are occasional traces of fire, and in one place near the Shunālang-slide, a considerable patch of young trees had been destroyed by burning.

General Remarks.—Surveys 48-50, show that the timber contractors have already felled as many trees as it is advisable at present to remove from the southern part of this forest, but if a tolerable slide can be arranged for the northern part, a good many trees could be got, as it is of considerable extent and untouched. We may assume an area of 200 acres and about 1,500 first class trees. These forest tracts belong to the Wazir of Poari.

BENGAL SECRETARIAT

No.	Date.	Names of Officers conducting the Survey.	Locality.	Deodar					Area Surveyed.			Trees per acre.		Remarks.
				First class above 6 ft.	Second class 4½ ft to 6 ft.	Third class 1½ ft to 4½ ft.	Fourth class, small.	Stumps.	Length in ft.	Width in ft.	Area in acres.	First class.	Second class.	
55	Sept 30	Dr. Stewart... Capt Wood ...	Shangrang Forest to Kibar Dogri...	102	167	103	241	...	3100	300	21·35	4·78	7·82	P Excelsa, 18
56	„	Dr Brandis ... Dr Stewart ...	Yolinge Forest ...	50	38	36	60	7	1300	300	8·95	5·58	4·25	P Excelsa, 14
57	Oct. 1	„	Purbani, Rauli Phultang... ...	52	82	67	110	5	1600	240	8·81	5·90	9·30	P Excelsa, 50 Dead 23
58	„	„	„	24	16	20	66	4	900	240	4·96	4·84	3·23	P Gerardiana, 9 Dead, 20
59	„	„	Barunalang Forest	53	109	194	110	78	2800	300	19·28	2·75	5·65	P Gerardiana, 16 Deodar dead, 40 Felled trees not removed, 5
60	„	„ ...	Simoling Forest ...	31	110	90	180	49	1000	300	6·89	4·49	15·97	P Excelsa, 25 Deodar dead, 35 Felled trees not removed, 39
61	„	„ ...	„ ...	38	78	21	89	12	2500	300	17·22	2·21	4·53	P Excelsa, 30 A Smithiana, 4 Deodar dead, 10
62	„	„	Ralda Forest of Skiba	41	120	240	302	8	3000	250	17·22	2·38	6·96	P Excelsa, 6 P Gerardiana, 3 Deodar dead, 70
63	„	„ ..	„	22	38	200	50	1	700	250	4·02	5·47	9·45	P Gerardiana, 18 Deodar dead, 16
64	Oct 3	„	Tisala Forest of Rispa, left bank of Teedong stream	35	95	180	72	69	1900	250	10·90	3·21	8·71	P Gerardiana, 31 Deodar dead, 25

Purbani Forests.

Nos. 55—58. *Locality.*—The village of Purbani or Punung is situated on a terrace bounded by a steep slope towards the river. This terrace, which slopes gently upwards, is covered with fields and fruit trees. A second step leads to a higher terrace, on which the Dogri of Yolinge is situated; and on a third terrace above these are the fields of Kibar Dogri. The whole forms a kind of amphitheatre bounded on both sides by precipitous cliffs of rock. Deodar is found on the steeper slopes which separate the second and third terraces, and on the broken ground on either side at the foot of the rocks and partly on them. One tract only, called the Korang Forest, has been worked. This is situated on the head waters of the Korang-garang, a short stream which joins the river about a mile below Purbani. Here are two slides, and along this stream a number of trees were cut, near and above the road leading from Poari to Purbani. This forest was not surveyed. Survey No. 55 was taken along the top of a ridge running west north-west; slope of top 20°. Soil, fair, but full of boulders and destitute of grass. Trees stunted and branching, and first class trees do not average 3 logs. Survey No. 56 went down a slope of 30° below last. Soil fair, and boulders fewer, trees good; first class averaging over 5 logs. In the part below this, just over Yolinge (not surveyed) the trees were again as in No. 55. These surveys were taken on the 30th September. On the following morning, the eastern portion of this forest was examined. The road led from the camp near Purbani through the fields on the first terrace up into broken ground. The Forest tracts marked Nos. 57 and 58 may be considered as a continuation of No. 56. The rock is gneiss and granite; the slope 30°; aspect west north-west; old cultivation terraces in parts. Young trees springing up freely wherever there is space. Trees taper quickly and branch much. First class average about 100 feet or 4 logs. Little scrub, and many marks of fire.

In these tracts the following trees were measured:—

(1.) Stump at 3′ 6″ from ground, girth 11′ 9″ rings 383
(2.) „ „ 2′ 6″ „ „ „ 6′ 1″ „ 160 } near the top of the Forest No. 56.

(3.) „ „ 4′ „ „ „ 7′ 4″ „ 90
(4.) „ „ 3′ „ „ „ 5′ 8″ „ 73 } at foot of Forest No. 56 near cultivation.

The two first trees are instances of a very slow, the two last of moderately rapid growth, probably, because grown on a more gentle slope.

Near the Yolinge Dogri a large tree was measured 34′ 4″ in girth, several of its branches broken, and the tree fast declining. The age cannot be estimated at less than 900 years, near it stand the shattered remains of two other giants, now dead. A large portion of the belt of Forest which covers the first slope above Purbani consists of gnarled and stunted trees, the stems instead of being straight from the root, divide into numerous limbs at different heights above the ground; many have a straight top often of considerable size. Higher up, the trees are of the usual shape, and in some localities attain large dimensions, but they bear branches down to the ground.

General Remarks.—The greater part of these Forests has not been worked for export, as the slope is not sufficient to form regular slides to the river, and cultivation intervenes, but these obstacles are not insuperable, though the cost of the timber will be somewhat enhanced. If these Forests are to be preserved, demarcation is necessary to prevent the trees being mutilated. In the upper parts of Kunawur near the treeless region, Forests are more exposed to injury by the wasteful cutting of shingles, planks and poles for sale, while the branches of Deodar are lopped to a great extent to serve as litter for cattle. It is difficult to estimate the area of the Deodar localities in this part, still left intact, and available for export; about 200 acres with five first class trees on an average may be taken as an approximation. In the Purbani Forest 552 trees are reported to have been felled in 1859 and 1863.

Forests between Purbani and Riba.

Nos. 59—61. *Locality.*—A steep rocky precipice forms the face of the hill between the terraces, on which the fields of Purbani and Riba are situated. The rock is entirely granite. There are two roads joining these two villages. The lower road leads along the bank of the river to a point opposite the village of Rarang, where a rope-bridge is thrown across during winter. It then gradually ascends the precipice, until it reaches the village of Riba. The upper road goes along the face of the rocks, gradually rising, until it reaches its highest point near the Dogri of Simoling. One road is used in the winter, the other in summer. Deodar is scattered over the whole of these rocks; the best Forests are on the two flanks. Survey 59 was taken on the west side towards Purbani, along a path used by sheep and goats; leading from the Purbani Forest over a steep ridge and again down to the upper road, and along this until the ground becomes too uneven, and the trees too scattered, to admit of useful results being obtained. Survey 60 and 61 were taken from the point where the highest ridge of the rock is rounded, to the fields of the Simoling Dogri. A part of these Forests has been worked.

Soil, Slope, Aspect.—The elevation of the upper part of the Barunalang Forest is nearly 10,000′ and that of the Simoling Forest is not much less. The rock is granite throughout. The slope in both Forests is steep, between 30° and 40° and the aspect is north or N. N. West.

Rate of Growth and Size.—The trees are of fair size both in the Barunalang and Simoling Forests. A tree in the last named Forest tract had a girth of 17′ and a height of 120.′ The rate of growth is slow upon the whole, the probable cause being the steep slope of the Forest. The following stumps were measured:—

(1.)	Girth 5′ 10½″	rings 255	Barunalang Forest.
(2.)	„ 7′ 0″	„ 219	
(3.)	„ 8′ 5″	„ 196	
(4.)	„ 8′ 6″	„ 248	
(5.)	„ 9′ 7″	„ 166	Simoling Forest.

The growth is slow, a first class tree 6′ in girth being 156, and a second class tree 116 years old.

There is a great deal of Deodar between Simoling and Riba, and below the fields of Chuen and Batto Dogri, which like Simoling, occupy the top of a terrace. But from what we saw, and from information obtained on the spot, the whole or the greater part of this Deodar appears to be gnarled and stunted, similar to the belt of Forest described above Purbani. Higher up, and in localities more difficult of access, the trees are well grown.

General Remarks—The good Forests still remaining in the localities here described, may be estimated to cover about 200 acres, which, at 5 first class trees per acre, would give 1,000 first class trees. This estimate is probably not too high, if all localities are taken into account. Timber has been removed by two slides from the Barunalang Forest. In the Simoling Forest a large number of trees has been felled, but only a small proportion removed. The only practicable slide is down the bed of a nullah of which the road crosses the head. Those logs which could not be rolled down this slide, have been left lying. The trees were felled a few years ago, and hitherto the large quantity of outlying timber has been preserved from fire, but should a fire enter the Forest, it is to be feared that the standing trees, as well as those felled, will be destroyed. The felled timber should be cleared away as soon as possible.

Forests between Riba and Rispa.

No. 62—63. *Locality.*—The Forests between Riba and Rispa are very extensive, but, with few exceptions, of little value. The Cherang Garang divides them into two unequal parts. To the east of this stream Deodar is found only on the slope of the hill below the granite cliffs which rise above. This locality is called the Solling Forest. To the west the precipice approaches the river, and Deodar is found on a sloping terrace above this first step, and also further west, where the lower precipice ceases at the foot of the main line of rocks. These Forests are called the Ralda Forests. On the lower part of the slope, along the river, *Pinus Gerardiana* is the principal tree.

Soil, slope, aspect,—Grey schist appears only close to the river, higher up the rock is granite. Some of the best trees found in Survey 62, were between huge granite boulders. Survey 63 was on the first terrace above the cliffs, opposite the village of Akpa. Here are traces of old cultivation, but the terraces are almost obliterated.

Size of trees.—The first class trees in No. 62 average 80′ in height; one was measured 11′ in girth and 110′ in length. In No. 63 the size is smaller, between 60′ and 80′. All trees are branched nearly to the ground, but straight trees are found high up in localities somewhat difficult of access; near the river all Deodar trees are gnarled and have divided stems, as described before. On the 4th October we visited the Solling Forest, east of the Cherang Garang. At a distance, the trees looked well, because those branches which had taken the lead, were straight and had well formed pyramidal heads. But on examination we found in the whole Forest only three regularly shaped trees. Most trees divide into a number of limbs at different heights, in a few instances as high up as 15 feet. The causes of this are several. In some instances, snow or ice may break off the tops; in others, the top may wither from natural causes, but by far the most frequent cause of this irregular growth is the lopping off branches or the tops of the tree. Deodar has the peculiarity of throwing outside shoots after the main stem has been felled within a certain distance from the ground, and thus the old stump of a tree is often surrounded by a complete circle of large side branches.

These forests can hardly be reckoned as at present available, the stock of timber may be 1,000 first class trees at the outside.

Teedong Forests.

No. 64. *Locality.*—The Teedong stream joins the Sutlej from the South East. A portion of the lower slope of the hills on its left bank is covered with Deodar for the first three or four miles. We examined the Forest as far as the Doba Garang. Near the river the hills are covered with *Pinus Gerardiana*, but between this and a precipice of rock above, a considerable quantity of Deodar is found. The tree also grows along this stream and on the hill side beyond opposite the village of Tangi, and a small quantity grows in ravines on the right bank of the Teedong Stream. The two sides of the ridge facing the Doba garang offer a remarkable instance of the influence of the aspect on the vegetation. The North West side is covered with Deodar, the South East side is perfectly barren.

Soil, slope, aspect.—The slope of the forest surveyed varied from 35° to 40° with a northerly aspect. The rock was a hard dark grey quartzose schist. In a few places cultivation terraces, almost obliterated, were observed. The precipice above being granite, a few boulders of that rock are found below.

Rate of growth, size of trees.—The trees in the Forest surveyed were well shaped but covered with side branches to the ground, and the stems tapering quickly. The average height of 1st class trees was 50′ to 70′. The largest tree measured had a girth of 11′ and a height of 80′. A felled tree was 75′ long and measured 9′ at the butt end.

The average of seven trees, the rings of which were counted, gave 130 years as the age of a tree 6′ in girth, and 91 years as the age of a tree 4′ 6″ in girth.

Near the village of Rispa and in the neighbourhood of the Teedong stream, the Deodars were gnarled and had crooked and divided stems, apparently caused by lopping the top and branches for litter, poles, shingles, planks and other purposes. In the tract surveyed the large proportion of dead trees was remarkable. In other parts of the Forest, a still larger number was observed, yet the Forest was not overcrowded. This fact seems to indicate peculiarities either of soil or climate, unfavourable to a healthy development of the trees.

General Remarks.—It is reported, that the Deodar localities above the Doba Garang are are at present unworkable, on account of a steep precipice between them and the river. Between this stream and the mouth of the Teedong, three slides were examined. They are all in favourable localities, and it is stated, that the timber is sent down without much breakage. It is reported that, altogether, 272 trees have been felled in these Forests. Some timber has been felled for sale in the district. We saw a granary constructed of Deodar, 10′ × 6′ made of timber lately cut in the Forest, and were told, that it would sell for about Rs. 15 at Morung, the first large village in the treeless country beyond the Teedong river. These granaries are put together in the Forest, and taken to pieces for removal. The value of these Teedong Forests for export is not great. The localities producing good trees above and below the Doba Garang may be estimated at not more than 200 acres, which, at three first class trees to the acre, would only give 600 trees above 6′ in girth.

No.	Date.	Name of Officers conducting the Survey.	Locality.	Deodar					Area surveyed.			Trees per Acre		Remarks.
				First class above 6 ft.	Second class 4½ ft to 6 ft.	Third class 1½ ft to 4½ ft.	Fourth class, small	Stumps	Length in ft.	Width in ft.	Area in acres	First class	Second class	
65	Sept 7	Dr J L Stewart	Lipi Forest ...	39	34	6	...	12	702	200	3·22	12·11	10·56	
66	„	„ „	Jangi Forest ...	10	11	very	few	27	546	200	2·50	4·00	4·40	
67	„	„ ...	Manda Forest ...	20	19	„	„	29	546	200	2·50	8·00	7·60	
68	„	„ „	Bangrang Forest...	6	7	...	...	10	390	100	0·89	6·74	7·87	
69	„	„ ...	„ „ ...	9	12	9	...	18	603	200	3·04	2·96	3·95	
70	Sept 8	Dr Stewart ...	Skyamdangdang Forest above Akpa	14	8	10	very few	20	950	100	2·18	6·42	3·67	
71	„	„ ...	„	16	11	12	„	19	640	100	1·47	10·88	7·48	
72	Oct 5	Dr Brandis ... Dr Stewart ... Capt E Wood	Kashang Forest left bank of stream..	143	116	110	141	...	2500	200	11·48	12·46	10·10	
73	„	„ ...	Kashang Forest right bank of stream ...	40	46	51	16	14	800	250	4·59	8·71	10·02	P Excelsa, 6 P Gerardiana, 5 Deodar dead, 26
74	„	„ ...	„ ...	115	231	46	105	80	3300	250	18·94	6·07	12·20	P Excelsa, 3 Deodar dead, 6
75	„	„ ...	„ ...	59	52	12	39	40	800	250	4·59	12·85	11·33	P Excelsa, 2 Deodar dead, 26
76	Sept 8	Dr Stewart ...	At the head of the slide west of the Kashang river ..	16	...	...	...	6	290	100	6·66	24·24	...	P Excelsa, 1 Deodar dead, 8

Lipi and Jangi Forests.

Nos. 65—69. *Locality, &c.*—The highest available Deodars on the Sutlej are those stretching along the right bank of the Teti or Pijur, one of its affluents, from opposite the town of Lipi to its junction with the Sutlej 5 miles below. The forests here consist chiefly of more or less compact strips and patches on the steep sides of the range which skirts the Teti on the south-west. They are of similar character throughout, and are known by the names—passing downwards—of Lipi, Changrang, Bangrang and Manda; one small patch of forest, called Skirang, lies on a tolerably level spot close to the Teti, under the Bangrang Forest and Zuzhang, a dogri of Jangi, but with this exception, none of the Deodar is on level ground.

Surveys 65—69 were made across the slope of the hill in various parts of these forests, from the lowest, which is just above the junction of the Teti with the Sutlej, to nearly opposite Lipi.

Aspect, &c.—The aspect of all of these forests is nearly north-north-east, and the slope varies from 35°—40°. The rock is a grey schist, and the soil generally very scanty. The surface is arid and sparsely covered with trees, and almost destitute of shrubby and herbaceous vegetation. The ravines are occasionally rather rocky, but on the whole not unfavourable for the formation of slides. No traces of forsaken cultivation were observed.

Character of trees, &c.—*Pinus Gerardiana* exists in considerable proportion all over, and is almost the only tree here associated with Deodar. The latter are fairly symmetrical. Their size, however, is small, and they generally branch low on the trunk. One tree with a girth of 19′ 6″ was measured, the average of first class trees being 2—3 logs each, rarely more. The proportion of dead trees is moderate, and there are occasional traces of jungle-fires, although the Zemindars declare that there has been no setting fire to the grass since the issue of a prohibitory order three years ago.

General Remarks.—Within the last two or three years, since the pressure for timber became great, there has been a good deal of felling in all the better parts of these forests, at least eight regular slides being in existence; and most of the parts where felling has been carried on, have had as many good trees taken as can be spared. In the Lipi Forests 180, and in the Jangi Forests 215 trees are reported to have been felled in 1863; no definite estimate can be formed of the resources remaining.

Below the junction of the Teti with the Sutlej lies the exceedingly sparse forest of Pela, in which there is almost no Deodar, and downwards to Jangi and for some distance below, there are only a few scattered Deodars; about 1½ mile from Jangi occurs the Tikri Forest which is of small extent, and in which the first class trees are rarely over 2—2½ logs each. Mr. Arratoon has felled a few trees in it. Still further down lies the Kurti Forest in a bay between two spurs separating it from Tikri above and Skyamdangdang below. This is of considerable extent, from 400 to 500 acres, but the Deodars are for the most part thinly scattered (mixed with *Pinus Gerardiana*) and as the slope is low, the ground rocky, and the best trees a good way from the Sutlej, no systematic felling has been carried on.

Skyamdangdang Forest, above Akpa.

Nos. 70—71. *Locality.*—The right or north side of the Sutlej valley between the bend of the river above Rispa and the Kashang valley is more barren than the opposite side; on the lower slopes are scattered a good deal of *Pinus Gerardiana* and Deodar trees with divided and gnarled stems, and higher up small tracts covered with well-grown Deodar are found, but no continuous forest. The surveys 70 and 71 were made near the road leading from Akpa to Jangi, high up on some ravines, which come down from the west side of the spur that runs towards the bed of the river. The slope here was 30°, the aspect south-east, and the rock schist with fair soil. Another good Deodar locality was examined on our way from Rarang village to join the road over the Werang pass, where it descends into the Kashang valley. We left the road from Rarang to Pangi at the Topan-garang, and after passing some gnarled and mutilated trees, came upon a considerable number of well-grown Deodars scattered on a steep slope of the hill, on grey quartzose schist. A large tree had been felled with a diameter of 5′ 1″, with the following number of rings on two inches—19 near the centre, 47 half way between centre and circumference, 46 near circumference. This would give an average of 18 rings per inch, or for a radius of 30½ inches a probable age of 549 years. This would correspond to 107 years for a girth of 6′ and 74 years for a girth of 4′ 6″. This tree had grown on a slope inclined about 30° with an eastern aspect.

A remarkable fact deserves notice. A large proportion of the Deodar trees observed between Rarang and the Kashang valley have flat tops. This is caused by the terminal shoot withering, and no side branch taking its place. Tabulated Deodars are frequent near Simla and in other localities, but they are upon the whole scarce in Kunawur. Winds, snow or the nature of the soil may be the cause of this peculiarity in the growth of the trees. In the Akpa Forests 115 trees are stated to have been felled in 1863.

Kashang Forests.

Nos. 72—76. *Locality.*—The Kashang river joins the Sutlej between the villages of Rarang and Pangi. Deodar localities are found on the slopes on both sides of this river, commencing about half a mile above its junction with the Sutlej and extending upwards of two miles. The larger quantity of Deodar is on the west bank. The surveys were made along the road leading from the Werang Pass to Pangi. The trees in No. 72 were counted on the descent to the river from the Werang Pass, Nos. 73, 74, 75 were taken on the opposite side in ascending towards Pangi after crossing the stream, and No. 76 was surveyed along the road from Rarang to Pangi.

Soil, slope, aspect.—The slope of the tracts surveyed varies from 25° to 40°, the aspect from south-west to north-east. But as the valley is narrow, the influence of the aspect is of little moment. The rock on the left side is a hard grey schist, on the opposite side the schist is much concealed under granite boulders, and higher up the rock is entirely granitic.

Rate of growth, size, &c.—The shape and size of the trees is upon the whole very good. They are tall and moderately branched. Two large trees, both on the right side of the valley, were measured, the top of one was withered and broken off, this was 126′ high, with a girth of 19′ 6″, the other was 135′ high, with a girth of 17′; on the left side the first class trees average 10′ in girth, and 120′ in height. On the right side (No. 70) the survey passed three places cleared by avalanches from the top of the hill to the bed of the stream. Here the trees were gnarled, without any top, but with wide-spreading branches along the slope of the hill. In the Forest adjoining these avalanche paths, the stems of a number of trees were irregular near the ground, but had formed straight and well-shaped tops. There was no sign of cutting or lopping, so that possibly at some former period, avalanches passed over these trees and crushed them, but they recovered, when, owing to some unknown reason, the masses of snow took another path downwards.

General Remarks.—Some timber has been cut in this Forest by the Road Engineers and by villagers, hence the stumps counted along the line of survey. At present the timber of this Forest is not available for export, unless it is converted into portable scantling, or an artificial slide be made along the Kashang, which seems difficult. There is also a slide to the Sutlej at the opening of the valley on the west side, down which some timber has been thrown from the Deodar localities higher up. The trees registered in No. 76 were counted at the head of this slide, and the number of trees felled in this locality is reported at 93. The area of the Kashang Forest may be estimated at 500 acres, which, with an average stock of eight first class trees per acre, would give 4,000 trees.

No.	Date.	Name of Officers conducting the Survey.	Locality.	Deodar. First class above 6'	Second class, 4½ to 6'	Third class, 1½ to 4½	Fourth class, small.	Stumps.	Area Surveyed. Length in feet.	Width in feet.	Area in acres.	Trees per Acre. First class.	Second class.	Remarks.
77	Oct. 7	Dr. Brandis Dr Stewart	Forest between Kashang and Chini. (No survey)											
78	"	"	Rogi Forest near Rogi Village upwards on north side	140	90	175	215	80	1800	200	8·26	16·95	10·86	P Excelsa, 8 Dead, 17
79	"	"	The same downwards on south side	100	125	180	112	70	1400	200	6·43	16·97	19·44	P Excelsa, 4 Dead, 13
80	"	"	Kastiarang	170				72	..	.	about 81	2·12	——	Logs unremoved, 91
81	Sept 9	Dr Stewart	Runang Forest	43	26	177		6	1300	100	2·98	15·10	8·72	Dead, 36

DEODAR LOCALITIES BETWEEN THE KASHANG VALLEY AND CHINI.

No. 77. No Survey. On turning round the cliffs which bound the Kashang Valley to the west, Deodar ceases almost entirely, and *Pinus Gerardiana* takes its place, scattered over a wide extent of barren slopes, with here and there some gnarled and mutilated Deodar trees. There is a large quantity of fine timber of good size and shape is in the Malgun Valley above Pangi, above the junction of the two branches of the Malgun River, especially on the south branch. From this Forest the timber can only be made available by conversion on the spot. Between the Malgun River and Chini, there are no compact Deodar Forests, nor has any cutting by contractors been carried on, except in the neighbourhood of Teling, where 333 trees are reported to have been felled, and at Chini, where 74 are reported. The Deodar, however, is common all along (mixed largely with *P. Gerardiana*), but the trees, even where of large girth, are mostly short, gnarled and branching, the distance from the river is generally considerable, and the slopes not favourable. There are also several villages in this tract, and the timber is open to supply the necessities of the inhabitants for house building, &c. The trees entered in Appendix III under this number were measured by Dr. Stewart along the road between the Malgun River and Chini.

FORESTS BETWEEN CHINI AND MIRU.

Nos. 78—81. *Locality.*—Between Chini and Urni, Deodar is found scattered at a certain elevation on the cliffs of Gneiss, and the steep slopes, which in this part form the north side of the Sutlej Valley. Along the road from Chini to Rogi, and near the last named village, the trees are mostly gnarled and have divided trunks. In the large majority of cases this must be ascribed to the habit of the villagers cutting the tops and branches for agricultural and domestic purposes. Some trees also were observed with flat tops, this may be caused by the snow or wind. The only remaining Forests of any value are, one near the village of Rogi, on the west side of the small stream, between the old and new roads, and another called the Runang Forest on both sides of the new road, east of the Runang-garang. South-east of the Runang Forest, there were at one time several valuable tracts covered with Deodar, on the steep slope opposite the junction of the Buspa and Sutlej Rivers. But these Forests which may have covered an area of about 8 or 4 acres, have, as far as the present stock and the future reproduction of Deodar is concerned, been almost annihilated. These localities have been worked by Soda Singh, and we saw two of the slides used by him, one above the mouth of the Buspa, from the Kastiarang Forest, the other below, from the tract east of the Runang Forest, In a portion of the Kastiarang Forest, on both sides of the new road, 72 stumps and 91 logs and trees not removed, were counted—a portion of these had been destroyed by fire, which had also injured many standing trees. In the eastern part of the Runang Forest, very few trees remain; the stumps are numerous, indicating a Forest of about five first class trees per acre No seedlings or small trees were observed. The ground has been cleared at once, and apparently all possibility of a renewal of the Forest has been cut off.

That part of the Runang Forest, which remains intact, is on the slope looking towards the Runang stream, with a south-west aspect, and a slope of about 30°. The soil is plentiful, and not arid. A few moist places are occupied by *Ulmus*, *Acer*, and *Corylus*, otherwise the Forest is composed entirely of Deodars, with a few *Abies Smithiana* and *Pinus excelsa*. The trees are of very good size, with tall stems, which may give more than four logs on an average. Its area may be estimated at about 50 acres, which, at the rate of 15 first class trees, gives upwards of 750 trees available. As far as we could see, the difficulties of rolling the logs into the main river, which have hitherto protected this Forest, might be overcome. This tract should certainly be demarcated, and if a portion of the ground on both sides and above could be included and kept clear of cattle for a few years, the Deodar would probably spread, and the area of the Forest be gradually increased. This might be effected by planting a narrow belt of Deodar round the boundary line, between which and the Forest the ground would probably, after a number of years, be covered with seedlings. The locality seems well suited for the growth of fine Deodar. Survey No. 81 was made through this Forest along the new road.

In the *Rogi Forest* near the village, the trees were counted along two lines, both between the new and old roads, one upwards and one downwards. This forest is on old cultivation terraces. To judge by the probable age of the trees, the fields were abandoned about 250 years ago. The rock is a quartzose schist with mica. The general slope is about 30° and the aspect easterly. The size of trees is fair, but less than in the Runang Forest; average girth 8′ height 80′. The side branches are less numerous and smaller than in the forests in the upper part of Kunawur; young deodar is abundant. One tree 9′ in girth was 80′ high, another measured 12′ 1″ and 98′; there has been some cutting in this Forest by the inhabitants of the neighbouring villages, and by the Road Department, especially in the lower part. The cliffs below the new road make it impossible to roll logs down to the river unless a passage for the timber is blasted. The rate of growth in this Forest is moderate. From the figures given in the Register of trees measured, it appears that the age of a first class tree in girth 6′ may be assumed at 119, and that of a second class tree 4′ 6″ in girth at 87 years. The area of the forest may be estimated at 50 acres, which at 15 trees per acre would give 750 first class trees in this forest; 249 were actually counted in the portion surveyed.

This forest should be demarcated and carefully preserved.

MIRU, CHERGAON, LASTAH, KANDARI, AND OTHER FORESTS ON THE RIGHT BANK OF THE RIVER.

No. 82. No survey. On the right bank of the river below the Runang-gad there are several forests of straggling Deodar, of which some of the more important may be enumerated. None of these were visited.

(1).—On the east side of the Tsoiling gad, which runs between Urni and Miru, a forest high up the slope; near Miru 91 trees were felled in 1860 and 1862.

(2).—Above the village of Chergaon.

(3).—The Lachmi Forest below the Rushnang Station. A slide has been formed by rolling logs down from this forest; it falls into the Sutlej opposite the mouth of the Melgad. 236 trees are reported to have been felled in 1859-60-62.

(4).—The forests on the Wangar River. In one locality, called the Babee Forest, on the left side of the stream, several hundred trees were felled some years ago; they were rolled and thrown to the bottom of the valley. Though the Wangar River rises considerably in the rains, the bed was found to be too rocky to admit of timber being floated.

(5).—The Lastah Forest, opposite Nachar. Here 361 trees are reported to have been felled from 1860 to 1862. A quantity of timber was thrown down a steep bed of a torrent, but most of the logs were shattered to pieces.

(6).—The Kandari Forest on the right side of the valley is supposed to contain a considerable quantity of timber, which, however, could only be removed if cut up on the spot.

(7).—There is Deodar on the Kach gad, which joins the Sutlej opposite Soongree; above the village of Chikaba opposite Taranda; on the Shorang gad and Rupi gad, which join the main river, the Shorang opposite the Choundeh gad, and the Rupi below. The last is the lowest side valley with Deodar Forests of which we could hear, on the right side of the river in Bussahir.

DEODAR LOCALITIES ON BOTH SIDES OF THE ROAD BETWEEN FAGU AND NAGKANDA.

No. 83. No survey. These are as follows arranged according to the territories in which they are situated:—

(1).—Komharsen. Above the village of Komharsen.

(2).—Komharsen. The Kadelli Forest on the new road from Nagkanda to Muttianah; on a slope to the north. Annual rings were counted on one tree, the girth was 5′ 9″ and the number of rings, 93. The size of the trees is good.

(3).—Komharsen. The Imbri Forest north of the Giri river.

(4).—Kuental. The Kokrani Forest south of Muttianah, near the old road from Theog to Muttianah.

(5).—Kuental. The Tikor Forest west of the road from Theog to Muttianah.

(6).—Theog. The Kaleri Forest on the east side of the road.

(7).—Theog. Kunli Forest on the west side of the road.

(8).—Bajee and Madhan. The forests north and north-east of the Shali Peak.

(9).—Gund. A Forest east of Gund village.

CHAOG FOREST.

No. 84, Chaōg Forest, 17th October. *Locality.*—This forest occupies the north and north-west slopes, and the sides of a spur thrown out from the Mahassu ridge at Fagu to the south-south-east. The forest commences about 1½ or 1¾ mile below Fagu. The road descends rapidly from the bungalow about 1,200 feet, to a depression or Col in the ridge, where two Buniahs' shops are built. This place called Chaōg, gives the name to the forest. The elevation of the bungalow is 8,200′; the houses of Chaōg are at about 7,000′. From here the

ridge rises again a few hundred feet. The south-west side is stated to be bare, but the north-west slope is covered almost exclusively with Deodar. The area of Deodar-producing forest may be estimated at between 600 and 800 acres. Proceeding from Chaōg along the main road, which traverses the entire length af the forest, a tract is first met, where all trees have been converted into broomsticks by the lopping of side branches for litter. The Rajah of Kuental, in whose territory the forest is situated, allows the Zemindars to cut the branches for this purpose. The trees have, however, been thus mutilated on the outskirts only. Further to the south, is the finest part of the forest. This is reserved for the temple which is in the forest on a small elevation a few hundred yards south of Chaog. The Temple Forest has several years ago been demarcated by pillars of rough stone, which seem to answer well No one is allowed to cut trees within this boundary line, a few trees only have been felled for repairing the temple. Here the trees are magnificent. On an area of about 10 acres, I counted 400 first class trees, or 40 first class trees per acre. One tree was measured 10′6″ in girth and 155′ in height, another had a girth 18′3″ and was 80′ high. A large proportion of the first class trees in this part has a girth of from 8 to 10 feet. These trees do not diminish in girth till high up the stem. One tree, which had been felled, had a butt girth of 8′4″ and a girth at 40′ of 7′2″. Outside the Temple Forest and along the road, which skirts the north-east slope of the hill, a large proportion of the first class trees have been felled. Young trees are springing up in large numbers. Lower down, the slope of the hill is covered with a large extent of rich forest almost untouched, containing trees of good size. At a small temple called the Kalōr Deota, the spur divides. Deodar is found in the hollow between the two branches, and on the north-side of the northern branch ; lower down the hills, the upper part of the slope and the south-east face of the spur are quite barren.

In its present state the Chaōg Forest way be estimated to contain upwards of 3,000 first class trees. The rate of growth is not very favourable. The soil is apparently poor, the rock is clay slate, but where forest has been growing for some time, and vegetable mould formed, the soil has apparently improved. I observed in the sections of the larger stumps that the rings near the centre, which were formed while the tree was young, were frequently smaller than those on the outside, which is the reverse of what is usually the case. The stumps on which the rings were counted, were selected as average specimens of good and slow growth in the different parts of the forests visited by me, and yield the following results :—

Total rings of the innermost 4 inches, 35, 67 28, 29 ; average 40 rings.

Total rings on four inches from the 8th to the 12th inch,—22, 26, 18, 19 ; average 21 rings.

Age of I class trees 105, 114, 58, 79, 194 years;—average 110 years.

„ II „ 85, 99, 44, 61, 146 „ „ 87 „

The Buniahs have the forest at present in their hands. They pay the official who has been placed in charge by the Kuental Rajah, a certain rate according to the girth of each tree felled, and hire sawyers and coolies to carry away the timber. The greater part of the tops and branches are on the spot converted into charcoal, and it is gratifying to find this forest well cleared of inflammable matter. Nearly the whole of the timber now cut, and the charcoal prepared in this forest, is carried to Simla. One man carries as much as 3 cubic feet of timber, weighing upwards of 120 lbs. This forest was for some time leased by Lord William Hay, late Superintendent of Hill States, on account of Government. If its extent were larger, it might be worth while to make a cart road from it to Simla, but its present resources would not justify such an outlay.

Ropur Timber Depot.

No. 85.—*Ropur Timber Depôt.*—(November 5.) This depôt is at present used only by the Native timber dealers, who collect and raft their timber at Neila, about 30 koss above Ropur, at the great bend of the Sutlej River. This place is situated in the State of Belaspoor, and the Rajah levies one anna on every log of timber rafted. The rate is the same for large and small logs of Deodar and other kinds of timber. To avoid payment of this duty, Mr. Arratoon collects and rafts his timber at Phalan, 5 koss above Anandpoor and 10 koss below Neila. This is in British Territory, in the Hooshiarpoor district, and no duty whatever is levied on the timber collected there. The Native dealers, however, find Neila more advantageous, as rope and bamboos are cheaper there.

The rafts are small. If the logs are large, they contain only from 20 to 40, if small, upwards of 50. Four men go with each raft, each provided with a mussuk or inflated skin. The men engaged in rafting are from different places along the river between Belaspoor and Ropur. They are engaged by contract at from 6 annas to one Rupee per log, according to their size, the owner providing ropes and bamboos which are tied across the logs. The rope is made of *Munj* (Saccharum sp.). The passage down from Neila to Ropur, occupies about one month during this time of the year; every night the rafts are moored. During the height of the rains, no floating is possible.

At Neila the timber is captured and collected by mussuk men, who are engaged on monthly pay.

Drift and Lawaris timber.—All timber which is found in the river without the mark of a forester, is considered as Lawaris, and as such is the property of the Government of the

territory where it is found. The different Native Chiefs, through whose territories the Sutlej River passes, annually let out the right of collecting this drift timber. In Bussahir the lease is for 5 years and it has been given to Mr. Arratoon for Rs. 700 per annum. The same person has also leased the right of collecting the drift timber in the British Territory under the Deputy Commissioner of Hooshiarpoor for Rs. 700 annually.

Below Bussahir is the British Territory of Kepu (Kotgurh.) Here Surdah has the lease for Rs. 60.

The following are the leases in the territories along the river below Kotgurh :—

	Rs.
Komharsen, left bank	270
Shangri, left bank	150
Baji, left bank	350
Mangai, left bank	120
Sukhēt, right bank	1,500
Belaspoor, both banks	3,200

The aggregate of the amounts paid for these drift timber leases, thus amounts to Rs. 7,050 per annum.

The lessees for Belaspoor have three chowkees with four mussuk men at each chowky, whose pay is about Rs. 6 per mensem, and whose duty it is to examine all logs that pass, and to seize all those which have no mark.

The amounts which are paid for these drift timber leases, show that the outturn of Lawaris timber must be good. The foresters whom I met at Ropur complained that people were in the habit of cutting out marks and putting on theirs, and afterwards claiming the timber. The temptation to dishonest practices on the part of the drift timber lessees is doubtless great. As there will be a considerable quantity of old private timber in the river for the next 3 or 4 years, in addition to the Government timber, some arrangements should be made to place this matter on a satisfactory footing. It may be expedient under the Government Forest Act to frame and pass forest rules for the Punjab, by which the marking of timber and the use of implements for marking timber is prohibited for the Sutlej, and such other rivers in British Territory as may be found necessary, and the management of waif timber generally is put on a regular footing. The assent of the different Chiefs of Native Territories along these rivers to such rules should then, if possible, be obtained, and authority granted by them to the Forest Officer to regulate all drift timber matters and to punish offenders. It will then have to be considered, whether it may not be necessary to lease the right of collecting drift timber in the different Native States. The main objection is the expense, Rs. 7,050 is more than is likely to be covered by the sale of the *bond fide* unclaimed timber.

Should the lease be decided upon, then all unmarked timber would be collected at a depôt, say at Neila or Ropur, and monthly notices would be published inviting claimants to prove their claims and to redeem the timber by payment of a share of the outlay incurred. Timber remaining unclaimed would be sold on account of the Forest Department.

Sale of timber at Ropur.—Very few logs above 12 feet in length were at the depôt at the time of my visit; the majority did not exceed 10 feet, eight annas per cubic foot is stated to be the usual price for good logs of this length. I was surprised to see a large proportion of small timber, logs split half through, and short pieces shattered on the slides before reaching the river. All these, if Deodar, are said to be saleable, though they may only fetch a few annas, each. From enquiries made and from examining the timber at Ropur, it would seem that the timbers receive the principal injury in the forests and comparatively little on the river. The largest log at the depôt was 20 feet long and had a diameter of 41 inches. It was from the Dippi Forest and the tree was 190 years old. Other logs had a diameter of 4 feet, but were shorter. The logs are hauled up out of the river on a slide formed by two lines of logs about 6' apart. The work is done by hand labour, Rs. 11 being paid for 100 logs, large or small; if very large a few Rupees are added as a present.

Some timber is cut up into sleepers here, these are sent down by water to Phulour; a large proportion of the round timber is carted to Umballa, 4 or 5 annas per cubic foot being the usual rate paid. The distance is 35 koss; one cart carries 25 cubic feet, the average size of a large log. Some kail, P. excelsa and cheer, P. longifolia, is brought down to this place from the Belaspoor Territory; kail sells for 3 annas per cubic foot, as an inferior wood for building and other purposes; cheer is mostly used for the building of large flat-bottomed boats. It stands many years under water and is much stronger than Deodar. I saw two large planks of this timber 30 feet long and 24 inches wide. The bottom of these boats is bent by wetting the timber.

Former working of the Sutlej Forests.—From the localities in the Komharsen and Baji Territories, timber was sent down to the Sutlej about 15 years ago. About 1850, Soda Singh commenced to cut timber in Kunawur, at that time he paid two annas a tree to the Rajah. Soda Singh had formerly been employed in cutting timber in the Mahassu Forest. Mr. Arratoon commenced several years afterwards, and has since then been the principal trader on the Sutlej River.

APPENDIX II.

Abstract Statement of the Forest Valuation Surveys of Bussahir, showing the trees estimated to be available in the different Divisions and Districts

No. of Forest Survey.	Forest.	Observed. First Class.	Second Class.	Stumps.	Area in Acres.	Estimated. Area in Acres.	No. of First Class trees.	Working Division.
	A. *Lower Sutlej Forests, left side,*							
1	Forests below Soongree ...	...	...	...	...	Not estimated		
2	Soongree ...	53	18	...	2·87	20	600	
3	„ ...	121	84	...	4·83			
4	East Nachar ...	341	102	...	6·56			I Division, Nachar and Dippi Forests. 3,000 trees may be felled in 1865.
5	„ ...	43	54	...	1·87			
6	West Nachar ...	91	111	6	3·21	200	4,000	
7	„ ...	114	85	..	3·67			
8	East Nachar ..	82	18	44	2 30			
9	Dippi	4	4	10	1·72			
10	„	18	48	84	6 89	Not estimated.		
11	„	19	43	151	8·61			
—	Kusthaland Ramni	...	...	...	..			
12	Janee ...	65	47	5	22 04			
13	„	38	21	3	8·95	160	1,600	
14	„	107	93	7	14·14			II Division, Punung and Phinla Forests. 3,000 trees may be felled in 1866.
15	Punung . ..	10	23	125	13·09	Not estimated		
16	„	6	17	63	6·89			
17	Phinla	37	34	45	7·57			
18	„	95	69	...	5·71	300	3,000	
19	„	12	6	...	10·10			
—	Jumpan... ...	...	...	...	..	Not estimated		
20	Wasankan ...	40	26	1	2·87	300	3,000	
21	Chokro	23	17	35	20·60			
22	Kiuden	83	75	9	5 05			III and IV Divisions, Kilba and Kunai Forests. 6,000 trees may be felled in 1867 and 1868.
23	„	19	11	...	0 33			
24	„	57	33	7	1·60	300	6,000	
25	„ ..	35	57	...	5·74			
26	Kilba	22	71	115	17·90	Not estimated		
27	Kunai	.	.	.	..	...	..	
27	Kumkumi	...	...	...	..	..	...	
27	Rapung or Sapni	.	..	410	14·68	200	2,000	
	Total	1,535	1,467	1,070	199·88	1,480	20,200	
	Add Forests not estimated and scattered Deodar, say .. .	...	...	...	...	...	9,800	
	Total trees available in Lower Sutlej Forests, left side ...	...	...	...	...	...	30,000	
	B. *Buspa River Forests.*							
28	Churi ..	18	19	...	4·59			
29	„	12	13	.	1·60	120	600	V Division, Buspa Forests. 3,000 trees may be felled in 1869.
30	Buru	42	38	...	6·89			
31	„	75	103	...	13 20			
32	Rapur	29	23	21	5·05			
33	Jungari... ...	10	17	47	3·21	300	1,500	
34	„	42	68	..	4·59			
35	Shoang ..	40	50	41	7·80			
	Carried over ...	268	330	109	46 93	420	2,100	

Abstract Statement of Forest Valuation Surveys,—continued.

No. of Forest Sheet.	Forest.	Observed. First Class.	Second Class.	Stumps.	Area in Acres.	Estimated. Area in Acres.	No. of First Class trees.	Working Division.
	Brought forward	268	330	109	46·93	420	2,100	
36	Chasoo	...	...	...	...	200	1,000	V Division, Buspa Forests. 3,000 trees may be felled in 1869.
„	Chidu							
„	Limsantang ...							
37	Serinche ...	7	22	27	7·57	A few hundred first class trees		
38	„	7	23	76	9·18			
39	„	1	4	11	3·21			
40	Rakcham ...	22	17	16	1·38	Not estimated		
41	Yak Bursari ...	30	58	44	20·66			
	Barra Bursari ...	...	...	...	...			
	Total of Buspa Forests ...	335	454	283	88·93	620	3,100	
	Add Forests not estimated and scattered Deodar, say	...	...	...	...	...	2,900	
	Total of Buspa Forests ...	...	...	...	...	...	6,000	
	C. *Upper Sutlej Forests, left side*							
42	Ralli and Rakcham ...		...	...	...	Not estimated		VI Division, Ralli, Mebar and Barung Forests. 3,000 trees may be felled in 1870.
43	Mebar	19	36	8	3·67	350	2,500	
44	„	28	26	...	4·13			
45	„	60	90	3	8·26			
46	„	48	11	7	5·51			
47	„	30	33	48	8·72			
48	Barung	136	136	12	18·59			
49	Stalimpi ...	77	26	6	12·10	150	1,000	VII Division, Poari Forests belong to a Wazir Surjeet Sing, (if leased, 3,000 trees may be felled in 1871).
50	Tanglin ...	.	...	..	.	Not estimated		
51	Poari Forests. Shunalang	20	39	81	5·86	200	1,500	
52	„ ...	9	50	5	8·95			
53	Kanunki ...	11	33	22	9·18			
54	Shangrang ..	36	57	...	4·59			
55	Purbani Forests. Shangrang Kanarang	102	167	...	21·35	200	1,000	VIII Division, Purbani, Riba and Rispa Forests, and Forests on the right bank, 3,000 trees may be felled in 1872.
56	Yolinge ..	50	38	7	8·95			
57	Rauli Phutang	52	82	5	8·81			
58	„ ...	24	16	4	4·96			
59	Baru nalang ...	53	109	78	19·28	200	1,000	
60	Simoling ...	31	110	49	6·89			
61	„	38	78	12	17·21			
62	Ralda	41	120	8	17·22	...	1,000	
63	„	22	38	1	4·02			
64	Tinala	35	95	69	10·91	200	600	
	Total	922	1,390	425	209·16	1,300	8,600	
	Total Upper Sutlej Forests, left side	...	...	. .	...	...	8,600	
	Add Tanglin Forests and scattered Deodar (say)	...	...	...	...	. .	9,400	
	Total	...	...	...	...	...	18,000	

Abstract Statement of Forest Valuation Surveys,—continued.

No. of Forest Survey.	Forest.	Observed. First Class.	Observed. Second Class.	Observed. Stumps.	Observed. Area in Acres.	Estimated. Area in Acres.	Estimated. No. of First Class trees.	Working Division.
	D. *Sutlej Forests, right side.*							
65	Lipi	39	34	12	3·23			VIII Division, 3,000 trees may be felled in 1872.
66	Jangi	10	11	27	2·51			
67	Manda	20	19	29	2·51	Not estimated		
68	Bangrang ...	6	7	10	0·89			
69	„	9	12	18	3·06			
70	Akpa	14	8	20	2·18			
71	„	16	11	19	1·47			
72	Kashang, left side	143	116	...	11·48			
73	Kashang, right side	40	46	14	4·59	Not available at present		
74	„ ...	115	231	80	18·93			
75	„ ...	59	52	40	4·59			
76	„ ...	16	...	6	0·66			
77	Kashang to Chini	...	...	...	...	Not estimated		
78	Rogi	140	90	80	8·27	50	750	
79	„	109	125	70	6·43			
80	Kastiarang ...	170	...	72	80·00	Not estimated		
81	Runang	45	26	6	2·98	50	750	
82	Miru to Kandari..	...	...	...	...	Not estimated		
	Total	951	788	503	153·78	100	1,500	
	Add scattered trees and forests not estimated ...	...	...	...	...	...	2,500	
	Total	...	..	...	...	...	4,000	

SUMMARY.

Main Divisions.	Working Divisions.	Observed. First Class.	Observed. Second Class.	Observed. Stumps.	Observed. Area in Acres.	Estimated No. of First Class Trees.	Trees reported to have been felled.
Lower Forests, left side	I, II, III and IV	1,533	1,467	1,070	199·88	30,000	9,268
Buspa Forests ...	V	335	454	283	88·93	6,000	3,039
Upper Forests, left side	VI, VII, and VIII	922	1,390	425	209·46	18,000	4,378
Sutlej Forests, right side	VIII	951	788	503	153·78	4,000	2,921
	Total	3,743	4,099	2,281	652·05	58,000	19,606

Note.—The true number of trees felled is believed to be about 30,000.

APPENDIX III.

Abstract Statement of Deodar trees examined to determine rate of growth.

Number.	Forest and number of Survey.	Number of tree.	Age, (number of rings counted).	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft. in.	ft. in.			
1	Nagadār 1	1	46	9	...	5 2	48	37	
		2	45	9	...	5 2	47	36	
		3	31	9	...	5 2	33	22	
		4	38	9	...	5 2	40	29	
		5	74	12	...	6 8	61	36	
		6	68	11	...	6 2	64	42	
		7	48	10	...	5 8	52	35	
		8	67	12	...	6 8	54	32	
	Average	..	...	...	...	...	50	34	
2	Taranda 1	1	81	13·5	...	7 6	64	47	
		2	108	15	...	8 3	76	56	
		3	80	10	...	5 8	84	62	
		4	55	13·5	...	7 6	43	32	
	Average	...	...	...	...	...	67	49	
3	Nachar 4—8	1	227	17·75	10 6	9 9	130	97	
		2	223	16	10 6	8 10	127	96	
		3	466	29·25	18 10	15 9	148	111	
		4	191	13	8 0	7 2	143	107	
		5	220	14	7 0	7 9	188	141	
		6	50	3·38	1 10	2 2	164	123	
		7	67	4·5	2 4	2 9	172	129	
		8	49	4·25	2 7½	2 8	112	84	
		9	53	5·9	3 0	3 6	106	80	
		10	62	4·75	3 2	2 11	117	88	
		11	151	8·25	5 0	4 9	181	136	
		12	82	7·75	4 1	4 6	120	90	
		13	160	10	5 4	5 8	180	135	
		14	117	8·5	4 6	4 10	156	117	
		15	194	11·6	5 3	6 5	222	166	
		16	87	6	3 5	3 7	152	114	
		17	61	4·5	1 5½	2 9	251	188	
		18	101	8·25	4 6½	4 9	133	100	
		19	62	4·25	2 5	2 8	154	115	
		20	113	5·62	3 5	3 4	198	149	
		21	43	2·62	1 4	1 9	193	145	
		22	58	6·25	3 8	3 8	95	71	
		23	81	5	2 9	3 0	176	132	
		24	327	16·3	9 3	8 11	159	120	
		25	347	24·3	13 4	13 2	90	62	
		26	150	13·85	7 8	7 8	117	88	
		27	66	7·73	4 0½	4 5½	98	73	
		28	210	22	12 11	11 11	98	73	
		29	227	15	8 3	8 3	165	124	
		30	307	28	16 0	15 1	115	86	At butt end.
		„	287	16	9 5	8 9	183	137	At 103 feet from ground.
	Average	...	...	...	6 4	6 3	149	112	

Inches.	1	2	3	4	5	6	7	8
0 to 2	7	10	7	8	7	10	9	7
2 to 4	9	9	6	7	7	9	9	6
4 to 6	11	7	5	7	9	11	8	8
6 to 8	11	11	5	8	15	13	10	12
8 to 10	8	8	8	8	18	16	12	16
10 to 12		...	.	.	18	9	.	18
	46	45	31	38	74	68	48	67

Inches.	24	25
0 to 2	13	14
2 to 4	22	10
4 to 6	43	12
6 to 8	47	29
8 to 10	26	19
10 to 12	45	19
12 to 14	30	21
14 to 16	45	49
16 to 18	56	27
18 to 20	..	35
20 to 22	..	42
22 to 24	...	36
24 to 26	...	34
	327	347

Abstract Statement of Deodar Trees, &c.,—continued.

Number.	Forest and number of Survey.	Number of tree.	Age, (number of rings counted).	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft. in.	ft. in.			
4	Dippi	1	122	12	6 7	6 8	111	83	
	9—11	2	145	14	7 0	7 9	124	93	
	Average	...	...	...	6 9	7 2	117	88	
5	Janec	1	140	14	8 6	7 9	81	50	
	12—14	2	258	29	18 6	15 7	84	63	
		3	43	5·75	3 5	3 5	76	57	
	Average	...	...	...	10 2	8 11	80	56	
6	Phinla	1	194	12·6	9 2	7 0	157	102	Inches. 1 2 — 0 to 2 15 23 — 2 to 4 19 19 — 4 to 6 35 13 — 6 to 8 37 25 — 8 to 10 39 23 — 10 to 12 49 — 194 103
	17—19	2	103	10·5	6 0	5 11	110	77	
7	Wasankan	1	180	...	6 1				Inches. 3 4 — 0 to 2 33 16 — 2 to 4 51 21 — 4 to 6 30 26 — 6 to 8 27 34 — 8 to 10 31 44 — 10 to 12 ... 51 — 172 192
	20	2	189	...	7 5	...	152	114	
		3	172	9·5	6 0	5 5	181	138	
		4	192	14	7 8	7 9	154	94	
8	Kiuden	1	84	...	3 3	...	...	116	
	22—25	2	149	...	5 4	...	168	126	
	Average of 6, 7, and 8	...	...	...	7 2	6 6	154	110	
9	Kilba	1	184	...	6 2	...	179	134	Inches. 4 5 — 0 to 2 29 16 — 2 to 4 17 24 — 4 to 6 12 24 — 6 to 8 29 27 — 8 to 10 27 30 — 10 to 12 12 25 — 12 to 14 ... 30 — 14 to 16 ... 19 — 126 195
	26	2	174	...	8 0	...	131	98	
		3	235	...	10 10	...	130	98	
		4	126	10·75	5 11	6 0	122	84	
		5	195	15	10 4	8 3	130	88	
	Average	...	...	...	8 1	7 1	138	100	
10	Kumkumi	1	170	...	9 9	...	104	78	
	27								
11	Sapni	1	176	...	12 0	...	88	66	
	27	2	120	...	7 6	...	96	72	
12	Bürü	1	104	11·8	6 4	6 7	96	72	
	30—31								
13	Rapur, Jungari	1	120	...	7 6	...	96	72	Inches. 2 5 6 — 0 to 2 11 12 11 — 2 to 4 7 13 11 — 4 to 6 7 15 11 — 6 to 8 14 17 12 — 8 to 10 11 31 16 — 10 to 12 13 20 15 — 12 to 14 13 12 9 — 14 to 16 24 — — 16 to 18 15 — — 115 120 85
	Shoang	2	115	14·5	8 2	8 0	54	37	
	32—35	3	94	...	5 7	...	101	76	
		4	156	...	8 2	...	115	86	
		5	120	12·25	7 4	6 10	97	55	
		6	85	10·5	5 9	5 11	66	43	
	Average of 10, 11, 12, 13	...	...	...	6 11	6 10	91	66	

Abstract Statement of Deodar trees, &c.,—continued.

Number.	Forest.	Number of tree.	Age, (number of rings counted.)	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft. in.	ft. in.			
14	Chasoo ...	1	127	25	13 1	...	58	44	Measured without the bark.
	36	2	74	11·6	6 7	...	65	54	„ „ „
		3	261	25·5	13 10	13 9	83	60	

Inches.	2	3	Inches.	3
0 to 2	14	15	12 to 14	17
2 to 4	18	17	14 to 16	25
4 to 6	12	13	16 to 18	28
6 to 8	11	17	18 to 20	30
8 to 10	8	16	20 to 22	29
10 to 12	11	18	22 to 24	36
	74			261

15	Chidu ...	1	107	16·3	8 10½	8 11	54	33	
	36	2	123	16·1	9 3	8 5	49	39	

Inches.	1	2	Inches.	1	2
0 to 2	10	10	10 to 12	11	12
2 to 4	9	13	12 to 14	12	16
4 to 6	8	12	14 to 16	9	13
6 to 8	9	5	16 to 18	9	15
8 to 10	14	7	18 to 20	16	20
				107	123

16	Limsantang 36	1	86	11·3	6 2	6 4	82	55	
	Average of 14·15 & 16				9 6	9 4	65	47	

Inches.	1	inches.	1
0 to 2	15	6 to 8	17
2 to 4	12	8 to 10	19
4 to 6	13	10 to 12	10
			86

17	Serinche ...	1	68	13·5	7 7	7 6	53	39	
	37-39	2	65	...	7 9	...	50	38	
		3	65	...	6 5	...	60	45	
		4	67	...	7 6	...	54	41	
		5	66	12·5	6 10	7 0	53	36	
		6	93	13	6 10	...	82	54	
		7	142	19·75	11 9	10 9	67	51	
			100	8·5	5 0	4 10	...	..	
		8	89	17·6	10 6	9 7	36	27	
			47	5	3 0	3 0	...	...	
		9	147	21·25	12 4	11 6	83	59	
		10	200	13·6	7 5	7 6	173	137	
		11	144	13	.	7 2	104	65	
		12	97	10·8	5 9	6 1	80	52	
		13	217	21·5	8 8	11 8	150	113	
		14	89	7·8	5 3	4 6	102	70	
	Average on steep slope				7 1	7 11	132	98	
	Do. on level ground ...				7 9	7 6	62	44	

Inches.	1	5	6	7	8	9	10	11	12
0 to 2	10	11	8	17	7	13	35	13	12
2 to 4	10	9	21	13	7	18	25	16	16
4 to 6	9	7	16	10	9	16	27	15	13
6 to 8	11	10	10	13	5	13	55	24	13
8 to 10	10	12	21	11	6	18	24	28	20
10 to 12	18	17	17	16	8	19	34	26	13
12 to 14		.	.	20	23	18	...	22	10
14 to 16		.	...	26	14	32			
16 to 18				16	10				
	68	66	93	142	89	147	200	144	97

Measured without bark.
„ at the butt end.
„ „ 52 feet from ground.
„ „ the butt end.
„ „ 64 feet from ground.
On level ground.
On steep slope facing S. at an angle of 30°.
„ „ „
On level ground.
On steep slope facing S. at an angle of 30°
„ „ „

18	Rakcham ...	1	130	15·	8 5	8 3	93	61	
	40	2	136	12·5	7 7	7	130	65	
		3	196	14·1	7 8	7 9	153	114	
	Average ...				7 11	7 8	125	80	

Inches.	1	2	Inches.	1	2
0 to 2	17	15	8 to 10	24	48
2 to 4	12	13	10 to 12	28	20
4 to 6	19	14	12 to 14	16	
6 to 8	14	26		130	136

Abstract Statement of Deodar trees, &c.,—continued.

Number.	Forest.	Number of tree.	Age, (number of rings counted).	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft. in.	ft. in.			
19	Yak Bursari 41	1	115	...	7 2	...	96	72	
		2	91	...	5 2	...	106	80	
		3	101	7·3	4 2	4 3	145	109	
	Average ...				4 2	4 3	116	87	
20	Mebar ... 43-47	1	129	18·3	8 4	7 5	96	65	
		2	183	14.5	...	8	59	38	
		3	152	12·	7 6	6 8	127	99	
		4	165	10·83	6 4	6 1	156	117	
		5	172	13·83	7	7 7	147	110	
		6	130	14·75	9	8 1	87	65	
		7	155	12·87	7 8	7 2	121	90	
	Average ...				7 6	7 2	113	83	
21	Yolinge ... 56	1	383	22	11 9	11 11	196	147	Near top of Forest.
		2	160	12	6 1	6 8	158	119	„ „
		3	90	14	7 4	7 9	74	56	At foot of Forest near cultivation.
		4	73	10·5	5 8	5 11	77	58	„ „ „
	Average near top ...				8 11	9 3	177	133	
	Do. at foot				6 6	6 10	76	57	
22	Barunalang 59	1	255	10·3	5 10½	5 10	260	195	
		2	219	13	7	7 2	188	141	
		3	196	13·6	8 5	7 7	149	114	
		4	248	15	8 6	8 3	160	110	
23	Simoling ... 60—61	1	166	15·6	9 7	8 7	113	85	
24	Peadun ...	1	226	...	9 8	...	140	105	
		2	208	...	11 8	...	107	80	
	Average of 22, 23, 24				7 10	7 6	160	119	

Inches.	1	2	3
0 to 2	14	12	26
2 to 4	14	7	35
4 to 6	17	8	24
6 to 8	22	12	16
8 to 10	22	15	20
10 to 12	20	23	22
12 to 14	20	34	9
14 to 16	...	42	
16 to 18	...	30	
	129	183	152

Inches.	3	4
0 to 2	15	25
2 to 4	33	22
4 to 6	33	35
6 to 8	30	31
8 to 10	29	36
10 to 12	30	31
12 to 14	26	38
14 to 16	...	30
	196	248

Inches.	1	Inches.	1
0 to 2	11	8 to 10	19
2 to 4	21	10 to 12	20
4 to 6	27	12 to 14	19
6 to 8	29	14 to 16	20
			166

Abstract Statement of Deodar trees, &c.,—continued.

Number.	Forest and number of Survey.	Number of trees.	Age, (number of rings counted.)	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft. in.	ft. in.			
25	Tinala Teedong valley	1	173	15	8 9	8 3	124	91	
		2	183	11·3	6 4	6 4	140	104	
	64 ...	3	276	17	10 5	9 4	138	90	
		4	173	14·3	8 8	7 11	128	80	
		5	108	11	6 2	6 2	86	49	
		6	299	17	9 6	9 4	188	141	
		7	115	14·5	8 2	8	107	80	
	Average ...	...	..	...	8 3	7 11	130	91	
26	Manda ...	1	240	19·5	10	10 7	144	108	
	Forest of Jangi ...	2	377	28 5	14	15 4	162	122	
	67 ...	3	63	4·5	2 4	2 9			
	Average ...				8 9	9 7	153	115	
27	Skyamdangdang ...	1	290	17·2	8 4	9 5	208	156	
		2	166	11·2	7 6	6 3	132	99	
	70-71 ...	3	229	11	6	6 2	229	172	
	Average ...				7 3	7 3	189	142	
28	Topan ...	1	571	30·5	...	16 4	101	76	
29	Kashang ...	1	100	10	5 8	5 8	104	84	
		2	111	9·3	5 1	5 3	100	69	
	72-76 ...	3	103	10·5	4 10	5 11	128	96	
		4	111	9·5	5 0	5 5	133	100	
	Average of 28-29 ...				5 2	5 7	113	85	
30	Forest above Chini ...	1	174	14	7 8	7 9	136	102	
		2	172	...	4 5	...	234	175	
	77 ...	3	130	17·5	9 2	9 7	85	64	
		4	74	5·2	3 0	3 2	...	105	
		5	30	1·5	0 9½	...	...	...	
		6	57	3·5	1 7	...	...	...	
		7	20	2 5	1 4	...	...	...	
		8	43	3	1 6	...	..	...	
		9	30	2 2	1 4	...	...	...	
		10	19	2·2	1 2	...	...	...	
		11	16	.	0 5½	...	...	...	
		12	12	1·5	0 9½	...	...	...	
		13	21	1·2	0 7½	...	...	...	
		14	28	3·2	1 10	...	..	..	
		15	98	4	2 10	...	..	..	
		16	41	5 6	3 6	3 4	..	55	
		17	29	4·3	2 7	...	...	...	
		18	35	5·5	3 1½	3 3	...	48	
	Average ..				5 3	5 5	152	91	

Inches.	1	2	3	4	5
0 to 2	12	23	16	26	12
2 to 4	18	35	17	21	9
4 to 6	39	28	25	13	14
6 to 8	24	20	36	22	16
8 to 10	24	26	34	35	27
10 to 12	28	38	37	39	30
12 to 14	28	13	31	17	...
14 to 16	..	...	37	..	...
16 to 18	...	...	40		...
	173	183	276	173	108

Inches.	1
0 to 10	95
10 to 20	235
20 to 30½	241

Inches.	1	2
0 to 2	23	15
2 to 4	23	21
4 to 6	19	17
6 to 8	21	18
8 to 10	14	22
10 to 12	...	18
	100	111

Abstract Statement of Deodar trees, &c.,—continued.

Number.	Forest and number of Survey.	Number of trees.	Age, (number of rings counted.)	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft. in.	ft. in.			
31	Rogi ...	1	215	16·8	9 9½	9 2	126	85	
	78-79	2	137	13	7 8	7 2	107	61	
		3	28	4·8	2 4½	2 11	...	...	
		4	33	3	1 7½	1 11	...	...	
		5	51	3·6	1 11	2 4	...	...	
		6	62	4 6	2 6½	2 10	...	...	
		7	46	5	3 0	3 0	...	...	
		8	57	6·2	3 8	3 8	...	70	
		9	61	4·3	2 8	2 8	..	..	
		10	66	6·5	4 2	3 10	95	71	
		11	57	7	4 4	4 1	79	59	
		12	60	8·7	5 0	5 0	72	54	
		13	29	3·5	1 10	2 3	...	...	
		14	30	3·3	1 10	2 2	...	...	
		15	37	4	2 6	2 6	..	...	
		16	160	11·5	6 2	6 5	156	117	
		17	70	8·2	4 5	4 8	95	71	
		18	131	8·5	4 11	4 10	160	120	
		19	157	15·2	8 4	8 4	113	85	
		20	121	10·2	5 6	5 9	132	99	
		21	148	11	6 5	6 2	138	104	
		22	165	11	5 10	6 2	168	126	
		23	138	13·7	7 7	7 7	109	82	
		24	147	12·7	7 10½	7 1	112	84	
	Average ...				4 8	4 8	119	86	

Inches.	1	2
0 to 7·8	85	61
0 to 10·6	126	107
0 to 16·8	215	...
0 to 18	. .	137

32	Kadelli ...	1	93	...	5 9	...	94	85	

Inches.	0 to 2	2 to 4	4 to 6	6 to 8	8 to 10
Rings	18	19	24	27	5

33	Chaog ...	1	130	14	8 6	7 9	105	85	
	84 ...	2	161	15·3	...	8 5	114	99	
		3	91	17	...	9 4	58	44	
		4	120	15	8 4	8 3	79	61	
		5	270	18	8 4	9 10	194	146	
	Average ...				8 5	8 9	110	87	

Inches.	1	2	3	4		1	2	3	4
0 to 2	19	32	18	12	10 to 12	9	16	8	7
2 to 4	16	35	10	17	12 to 14	20	18	10	7
4 to 6	24	19	7	16	14 to 16		16	8	19
6 to 8	29	15	10	18	16 to 19	...	...	10	12
8 to 10	13	10	10	12					
						130	161	91	120

Abstract Statement of Deodar trees, &c.,—continued.

Number.	Forest.	Number of tree.	Age, (number of rings counted)	Mean radius measured.	Remarks.
				in.	
34	Simla, north side, small trees ...	1	50	4·25	
		2	35	4	
		3	21	4	
		4	42	4	
		5	30	4	
		6	30	4	
		7	40	5	
		8	47	5·5	
		9	44	5	
		10	45	4·5	
		11	40	4·5	
		12	70	5	
		13	45	4·5	
		14	44	4·5	
		15	33	4·5	
		16	39	4	
		17	47	5·5	
		18	50	6·5	
		19	68	5	
		20	57	5·5	
		21	47	4·5	
		22	30	4	
		23	91	5	[An exceptionally slow grown tree on a dry slope of 40°]
	Average...		43	4·6	Age of I cl. =99
	North side, large trees	1	88	16	„ II cl. =73
		2	66	15	
		3	72	12	
		4	72	12	
		5	153	18	
		6	138	12	
		7	102	18	
	Average...		99	14·7	Age of I cl. =71
					„ II cl. =52

Number.	Forest.	Number of tree.	Age, (number of rings counted.)	Mean radius measured.	Remarks.
				in.	
	Simla, south side ...	1	54	6	
		2	94	9·5	
		3	42	6·5	
		4	43	5	
		5	100	12	
		6	43	4·5	
		7	31	3	
		8	70	6	
		9	40	4·5	Age of I cl.=91
	Average...		57	6·6	„ II cl.=67
35	Ropur timber Depôt ...	1	210	12	
	Purbani ...	2	180	12	
	Poari ...	3	98	7	
	Ditto ...	4	100	10	
	Ditto ...	5	110	9	
	Ditto ...	6	110	11	
	Akpa ...	7	202	13·5	
	Ditto ...	8	187	12	
	Ditto ...	9	225	18	
	Average...		158	11·6	Age of I cl. 145
					„ II cl. 106
	Kusthal ...	10	124	15	
	Ditto ...	11	107	14	
	Ditto ...	12	150	18	
	Kilba ...	13	109	15	
	Dippi ...	14	80	12	
	Ditto ...	15	165	15	
	Ditto ...	16	190	22	
	Punang ...	17	170	17·5	Age of I cl. 99
	Average...		137	16	„ II cl. 66
	Lawaris, or drift timber	18	96	12	
		19	297	18	
		20	125	15	
		21	270	20	
	Average...		197	16	Age of I cl. 131
					„ II cl. 96

Abstract Statement of Deodar Trees, &c.—continued.

Number.	Forest.	Number of tree.	Age (number of rings counted).	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				in.	ft.in.	ft. in.			
36	Bodeher, Jaonsar Bawur 2·3	1	71	11·6	6 7	6 6	69	53	
		2	58	6·5	4 2	3 10	...	63	
		3	41	5	3 2½	3 0			
		4	42	8	4 5	4 7	...	38	Measured at 3 ft.
			33	6·5	3 1	3 10	...	...	ditto ditto 28 „
		5	70	12	6 10	6 8	67	41	ditto ditto 3 „
			47	8	4 0½	4 7	...	...	ditto ditto 48 „
		6	78	13	6 10	7 3	68	51	

Inches.	1	2	3
0 to 1	5	6	7
1 to 2	7	6	8
2 to 3	8	8	7
3 to 4	7	9	16
4 to 5	6	9	9
5 to 6	6	20	
6 to 7	7		
7 to 8	9		
8 to 9	7		
9 to 11	9		
	71	58	41

37	Mashak, Jaonsar Bawur 5·8	1	98	8	4 2	4 7	...	78	
		2	64	8	4 4	4 7	...	62	
		3	143	29·3	17 0	15 8	50	38	
		4	47	10	6 2	5 8	46	33	
		5	83	12	7 0	6 8	79	52	Pinus excelsa ..

Inches.	1	2	4	5
0 to 1	14	8	5	8
1 to 2	12	7	6	5
2 to 3	4	6	5	5
3 to 4	8	8	4	5
4 to 5	8	8	4	5
5 to 6	9	8	4	8
6 to 7	9	9	3	8
7 to 8	18	10	3	10
8 to 9	16	...	4	9
9 to 10	...	...	5	10
10 to 11	...	...	4	10
	98	64	47	83

38	From ridge to Khattowa Jaonsar Bawur 11	1	66	9·3	5 6	5 4	64	50	
		2	50	6·75	...	3 11	...	50	

Inches.	2
0 to 1	9
1 to 2	7
2 to 3	6
3 to 4	7
4 to 5	4
5 to 6	5
6 to 7	9
7 to 8½	3
	50

39	Tutwa, Jaonsar Bawur 16	1	152	24	12 0	13 0	76	57	
		2	178	18·2	...	9 11	98	76	
		3	162	18	19 7	9 10	92	69	

Inches.	2	Inches.	2	Inches.	2
0 to 1	21	6 to 7	8	12 to 13	14
1 to 2	11	7 to 8	7	13 to 14	14
2 to 3	9	8 to 9	8	14 to 15	7
3 to 4	9	9 to 10	8	15 to 16	8
4 to 5	6	10 to 11	12	16 to 17	8
5 to 6	6	11 to 12	8	17 to 18	14
					178

40	Chilu, Jaonsar Bawur 17	1	95	10·6	6 0	6 0	91	65	
		2	44	2	...	...	...	...	A small oppressed tree

Inches.	1	Inches.	1
0 to 1	8	6 to 7	10
2 to 2	9	7 to 8	12
2 to 3	7	8 to 9	8
3 to 4	7	9 to 10	10
4 to 5	7	10 to 11	10
5 to 6	7		
			95

41	Chilaru, Jaonsar Bawur 18	1	98	19·25	11 7	10 6	51	33	
	Average of 36, 37, 38, 39, 40, & 41.				6 10	6 9	71	53	

Inches.	1	Inches.	1	Inches.	1
0 to 1	3	6 to 7	5	12 to 13	6
1 to 2	3	7 to 8	2	13 to 14	9
2 to 3	4	8 to 9	2	14 to 15	6
3 to 4	5	9 to 10	10	15 to 16	6
4 to 5	5	10 to 11	4	16 to 17	8
5 to 6	6	11 to 12	4	17 to 18	10
					98

Abstract Statement of Deodar Trees, &c.,—continued.

Number.	Forest.	Number of tree.	Age (no of rings counted.)	Mean radius measured	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.
				Inches.	ft. in.	ft. in.		
42	Bhagaruttee (logs measured at Hurdwar).	1	306	13 25	..	7 0	231	165
		2	190	10·6	5 9	5 7	227	162
		3	111	5	...	...	...	...
		4	118	8	...	...	..	114
		5	113	7	...	...	...	133
	Average ...	..	..	...	5 9	5 7	229	143
43	Raveo, (timber lying at the Lahore Depot).	1	186	Inches. 14·5	...	ft. in. 8 0	119	83
		2	128	16	...	8 9	90	57
		3	157	15·5	...	8 6	124	74
		4	265	15·5	...	8 6	158	122
		5	...	34·5	...	18 6	197	151
		6	247	17	...	9 4	134	93
		7	80	15	...	8 3	70	52
		8	245	28	...	15 1	91	63
		9	188	18	...	9 10	92	60
		10	155	18	...	9 10	91	67
	Average of trees 2,8,9, & 10 instances of quick growth						91	62
	do. 1,3,4, & 6			,, ,,	slow	,,	154	98
44	Chenab. Sleepers from Chenab Forests examinedat the Lahore Railway Station.	1	96	Inches. 6	...	...	208·7	140·1
		2	78	,,	...	...	158·5	109·5
		3	84	,,	...	...	159·9	113 7
		4	66	,,	...	...	128·1	90·3
		5	103	,,	...	...	178·9	132 7
		6	59	,,	...	...	107·3	77·9
		7	47	,,	...	...	83·8	61·4
		8	68	,,	...	...	123·2	89·6
		9	118	,,	...	...	214·6	155·8
		10	108	,,	...	...	216·1	150·3
		11	45	,,	...	...	88·7	62·1
		12	57	,,	...	...	91·5	70·5
		13	50	,,	...	...	100·6	69·8
		14	42	,,	..	...	74·2	54·6
		15	71	,,	...	...	121·6	90·8
		16	85	,,	...	...	149·4	110·2
		17	65	,,	...	...	101·8	79·4
		18	51	,,	...	...	85·5	64·5
		19	40	,,	..	...	79·1	55·3
		20	103	,,	...	...	162·8	126·4
		21	77	,,	..	...	134·5	99·5
		22	54	,,	...	...	100·0	72·0
		23	44	,,		...	76·2	58·6
		24	68	,,	...	...	123·2	89·6
		25	59	,,	...	...	114·2	80·6
		26	61	,,	...	...	132·8	88·9
		27	91	,,	...	...	160·0	118·0
		28	89	,,	...	...	171·8	121·4
		29	100	,,	...	...	194·3	136·9
		30	98	,,	...	...	180·8	130·4
		31	68	,,	...	...	116·3	86·9
		32	61	,,	...	...	102·4	77·2
		33	65	,,	...	...	122·5	87·5
		34	87	,,	...	...	149·1	111·3
		35	58	,,	...	...	110·9	78·7
		36	66	,,	..	...	116·6	85·8
		37	58	,,	...	...	106·3	76·9
		38	127	,,	...	...	225·9	165·7
		39	71	,,	...	...	121·6	90·8
		40	94	,,	...	...	172·2	124·6
		41	62	,,	...	...	110·3	80·9
		42	68	,,	...	...	127·8	91·4
		43	114	,,	...	...	185·8	141·9
		44	48	,,	...	...	94·0	66·0
		45	74	,,	...	...	122·3	92·9
		46	61	,,	..	...	107·0	79·0
		47	37	,,	...	...	69·2	49·6
		48	71	,,	...	...	137·7	97·1
		49	136	,,	...	...	237·9	183 7
		50	69	,,	...	...	126·5	91·5
	Average ...						134·0	97·1

Details of rings counted, and Remarks.

Inches.	1	2	3	4	5
0 to 1	22	19	15	9	7
1 to 2	25	17	19	11	9
2 to 3	15	18	13	16	13
3 to 4	20	20	30	18	15
4 to 5	18	24	34	14	20
5 to 6	20	22		19	24
6 to 7	24	23		15	25
7 to 8	26	25		29	
8 to 9	27	28			
		190	111	116	113

Inches.	1
9 to 10	27
10 to 11	19
11 to 12	16
12 to 13	16
13 to 14	19
14 to 15	19
	306

Inches.	1	2	3	4	5	6	8	9	8
0 to 2	12	11	12	33	35	20	14	13	18
2 to 4	17	15	19	36	48	27	16	13	16
4 to 6	27	16	20	35	35	25	17	18	18
6 to 8	30	17	26	20	37	33	18	18	19
8 to 10	25	24	36	26	32	30	20	23	
10 to 12	35	22	29	27	27	22	18	24	
12 to 14	40	18	15	22	27	24	19	25	
14 to 16				19	30	26	16	27	
16 to 18				25	...	25	19	27	
18 to 20				22	...	25	15		
	186	133	157	205	271	247	...	188	245

Inches.	1	2	3	4	5	6	7	8	9	10	11	12
0 to 2	18	16	33	19	36	18	17	21	37	30	14	20
2 to 4	29	27	18	20	34	20	14	23	30	31	12	22
4 to 6	49	1	33	27	33	21	16	24	42	47	19	15
	96	78	84	66	103	59	47	68	118	108	45	57

Inches.	13	14	15	16	17	18	19	20	21	22	23	24
0 to 2	15	13	28	28	24	23	10	36	28	17	17	24
2 to 4	13	15	21	29	35	14	13	41	29	17	18	20
4 to 6	22	14	22	28	16	15	17	26	25	20	14	24
	50	42	71	85	65	51	40	103	77	54	44	68

Inches.	25	26	27
0 to 2	18	13	20
2 to 4	17	18	32
4 to 6	24	31	30
	59	61	91

Inches.	28	29	30	31	32	33	34	35	36	37	38	39
0 to 2	28	28	28	22	24	18	28	20	21	20	35	20
2 to 4	25	31	30	25	19	22	32	15	23	17	40	29
4 to 6	36	41	36	21	18	25	27	23	22	21	43	22
	89	100	98	68	61	65	87	58	66	58	127	71

Inches.	40	41	42	43	44	45	46	47	48	49	50
0 to 2	35	21	20	34	13	30	21	11	19	30	19
2 to 4	25	20	22	40	16	23	20	12	25	47	25
4 to 6	34	21	26	31	20	21	20	14	20	53	25
	94	62	68	114	48	74	61	37	71	130	69

Abstract Statement of Deodar trees, &c.—continued.

Number.	Forest.	Number of tree.	Age (No. of rings counted.	Mean radius measured.	Measured girth.	Calculated girth.	Calculated age of 1st class trees.	Calculated age of 2nd class trees.	Details of rings counted, and Remarks.
				In.					
45	Chenab, (depôt near Wuzeerabad). ...	1	132	8	...	4 7	...	128	
		2		17	...	9 4	...	...	
		3	166	20·5	...	11 2	59	38	
		4	192	12	...	6 8	164	108	
		5	241	13	...	7 3	198	136	
		6	122	13·5	...	7 6	77	49	
		7	118	13·75	...	7 7	80	51	
		8	171	18	...	9 10	91	64	
		9	145	18	...	9 10	87	65	
		10	154	18	...	9 10	87	63	
		11	201	13·25	...	7 4	144	88	
		12	200	12·5	...	7	108	65	
		13	284	9	...	5 2	247	185	
		14	101	10·25	...	6 9	105	85	
		15	289	13·6	...	7 6	223	170	
		16	158	14·2	...	7 9	118	78	
		17	153	12	...	6 8	164	112	
		18	104	9·3	...	5 3	109	84	
		19	91	8·6	...	4 10		76	
		20	221	11·5	...	6 5	143	88	
		21	76	13·6	...	7 6	54	33	
		22	97	10·6	...	5 11	104	77	
		23	111	10·6	...	5 11	108	75	
		24	70	5·6	...	3 4	...	101	
		25	193	12	...	6 8	142	113	
		26	142	8·9	...	5 1	149	114	
		27	103	11	...	6 2	70	48	
		28	162	13·5	...	7 5	117	70	
		29	181	9·1	...	5 2	191	144	
		30	143	12·8	...	7 1	119	82	
		31	150	11·3	...	6 4	125	79	
		32	172	12·75	...	7 1	141	108	
		33	176	12 3	..	6 10	126	89	
		34	166	13	...	7 2	143	99	
		35	87	13·3	...	7 4	58	41	
		36	81	8·1	...	4 7	...	79	
		37	92	9·3	...	5 3	98	71	
		38	99	8·6	...	4 11	...	96	
		39	160	10·6	...	5 11	172	116	
		40	163	8·3	...	4 9	...	112	
	Average ...						124	88	
46	Jhelum (Depot near Jhelum) ...	1	233	21	...	11 5	77	55	
		2	219	R.	...	...	91	70	
		3	137	...	...	...	78	56	
		4	...	...	...	...	143	105	
	Average ...						97	71	
47	Swat River (Depot near Nowshera) ...	1	144	8	...	4 10	..	141	
		2	156	9	...	5 2	166	121	
		3	100	8	...	4 7	...	98	
		4	99	9	...	5 2	104	79	
		5	168	9·5	...	5 5	181	120	
		6	148	10	...	5 8	157	117	
		7	120	9	...	5 2	129	87	
		8	179	12	...	6 8	150	100	
		9	213	12	...	6 8	188	147	
		10	162	13	...	7 3	177	108	
	Average ...						156	112	
48	Cabul River timber (examined at Attock) ...	1	..	...	...	...	191	140	
		2	...	...	...	...	170	125	
		3	..	...	...	...	223	164	
		4	...	...	...	...	313	234	
		5	...	...	...	...	148	109	
		6	..	...	...	...	339	250	
		7	...	...	...	...	201	148	
		8	...	...	...	...	265	195	
		9	...	...	...	...	191	140	
		10	...	...	...	...	148	109	
		11	...	...	...	..	201	148	
		12	...	...	...	...	127	94	
		13	...	...	...	...	265	195	
	Average		...	...	...	...	214	158	

Details of rings counted, and Remarks.

Inches.	1	2	3	4	5	6	7	8	9	10	11	12	13
0 to 2	24	9	24	26	13	13	20	16	20	21	15	33	
2 to 4	36	9	22	39	11	10	16	12	14	23	13	59	
4 to 6	36	11	30	31	12	14	15	20	15	20	18	47	
6 to 8	36	10	36	45	14	16	15	19	16	27	21	31	
8 to 10	...	15	40	40	21	21	19	15	17	41	28	41	
10 to 12	...	16	40	30	37	31	13	19	15	37	37		
12 to 14	...	15	...	36	14	15	21	16	21	25	37		
14 to 16	...	18	..	..	...	...	34	21	24	42	31		
16 to 18	...	10	...	...	..	..	18	14	12	40			
18 to 20	...	15	...	...	...	...	...	...	...	18			
20 to 22	..	21											
22 to 24	...	20											
	132	166	193	241	122	118	171	145	154	294	300	234	

In.	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0 to 2	17	46	23	21	14	19	31	6	14	21	15	23	25	12	14	19
2 to 4	22	40	33	25	20	16	26	9	17	18	20	34	32	11	20	38
4 to 6	21	39	16	27	27	24	22	9	12	19	25	37	26	10	20	50
6 to 8	23	40	18	43	25	19	21	10	31	15	..	21	34	16	18	41
8 to 10	13	37	23	37	18	16	24	16	23	24		19	25	18	34	33
10 to 12	...	40	36	...	...	...	33	16	...	11		26	...	12	33	
12 to 14	...	38	19	...	...	...	36	10		...	..	25	...	24	18	
14 to 16	...	...	...	...	...	...	28									
	101	299	158	153	104	94	221	76	97	111	70	193	142	103	162	161

Inches.	30	31	32	33	34	35	36	37	38	39	40
0 to 2	22	16	30	21	26	7	17	19	16	28	23
2 to 4	18	15	29	17	23	12	23	16	27	27	25
4 to 6	25	18	24	21	30	10	24	20	22	28	40
6 to 8	19	33	28	33	22	13	17	18	34	37	27
8 to 10	25	33	26	25	32	13	..	19	..	40	46
10 to 12	34	35	13	30	33	11					
12 to 14	..	..	22	29	..	11					
14 to 16	..	..	..	..	..	10					
	143	150	172	176	166	87	81	92	99	160	163

Inches.	1	2	3
0 to 2	10	30	12
2 to 4	15	12	14
4 to 6	15	15	16
6 to 8	17	14	16
8 to 10	15	15	15
10 to 12	18	15	20
12 to 14	18	10	20

Inches.	1	2	3
14 to 16	23	15	24
16 to 18	24	22	
18 to 20	24	30	
20 to 22	24	20	
22 to 24	30	15	
	233	219	197

Inches.	1	2	3	4	5	26	7	8	9	10
0 to 2	20	26	24	20	17	20	14	20	24	18
2 to 4	52	30	20	18	33	34	20	29	31	24
4 to 6	30	30	26	21	30	26	28	24	70	30
6 to 8	30	32	24	22	44	28	28	30	24	40
8 to 10	...	32	...	18	44	30	30	30	30	50
10 to 12	...	..	...	...	...	..	..	40	34	
	144	156	100	99	168	148	120	179	213	162

APPENDIX IV.

Measurements of Deodar trees at different heights of the Stem.

Name of Tree and Locality.	No. of Tree.	Height.	Diameter.	Girth.	Proportion of lower and upper girth.
		Ft.	Ft. In.	Ft. In.	
Pinus longifolia.—	1	Stump.	...	5 3	100
Between Kanda and		10	...	4 10	92
Bandrouli, Jaonsar		20	...	4 8	89
Bawur		30	...	4 1	78
		40	...	3 9	71
		50	...	2 1	39
Ditto ...	2	10	...	5 2	100
		50	...	3 10½	75
Bodeher Forest Jaonsar Bawur ...	3	3	...	4 5	100
		28	...	3 1	70
		38	...	2 9	62
		48	...	2 3	51
		58	...	1 9	39
Ditto ...	4	3	...	6 10	100
		48	...	4 0½	59
Ditto ...	5	3	...	6 10	100
		48	...	4 6	65
		58	...	3 9	54
		68	...	3 1	45
Above Khattowa village Jaonsar Bawur ...	6	3	...	5 6	100
		21	...	3 11	71
Tutwa Forest Jaonsar Bawur ...	7	3	...	12 0	100
		48	...	8 3	69
	1	2	3 0	9 10	100
Nachar S.		27	2 4	7 9	78
		41	2 3	7 6	76
		55	2 2½	7 4	74
		94	1 9	5 11	60
Ditto ...	2	4	2 11	9 7	100
		18	2 10½	9 5	98
		32	2 8	8 9	91
		45	2 3	7 6	78
		59	2 2	7 3	75
		73	1 7	5 5	52
Ditto ...	3	2½	3 3½	10 9	100
		18½	2 11	9 7	88
		31	2 8	8 9	81
		44	2 7	8 6	79
		70	2 4	7 9	72

Name of Tree and Locality.	No. of Tree.	Height.	Diameter.	Girth.	Proportion of lower and upper girth.
		Ft. In.	Ft. In.	Ft. In.	
Nachar S. ...	4	3 0	4 11	15 10	100
		20 0	3 5	11 2	70
		36 0	3 5	11 2	70
		52 0	3 4	10 11	69
		69 0	3 3	10 8	67
		86 0	3 0	9 10	62
		103 0	2 9	9 1	57
		122 0	2 7	8 6	53
Ditto ...	5	Stump	4 6	14 7	100
		18 6	4 3	13 9	94
		33 0	3 11	12 9	87
		47 6	3 9½	12 4	84
		62 0	3 7½	11 10	81
		76 6	3 5	11 2	76
		91 0	3 2½	10 6	72
		105 6	2 10	9 4	64
		120 0	2 10	9 4	64
		134 6	2 6	8 3	56
		150 0	2 1½	7 1	48
Ditto ...	6	Stump.	...	10 6	100
		84 0	...	4 0	38
Ditto ...	7	Stump.	...	10 6	100
		96 0	...	5 0	47
Ditto ...	8	Stump.	...	18 10	100
		84 0	...	10 0	53
Kiuden	1	6 0	...	5 4	100
		18 0	...	5 2	97
		26 0	...	4 9	89
		34 0	...	4 6	84
		44 0	...	4 0	75
		54 0	...	3 7	67
Buru	1	Butt.	...	5 8	100
		49 0	...	3 10	67
Sangla	1	Butt.	...	6 2	100
		19 0	...	5 1	82
		34 0	...	4 3	69
		49 0	...	3 6	56
Serinche	1	2 0	...	11 9	100
		52 0	...	5 0	42
Ditto ...	2	3 0	...	10 6	100
		53 0	...	4 2	39
		64 0	...	3 0	28
Chaog	1	Butt.	...	8 4	100
		40 0	...	7 2	86
Tinala Forest	1	Butt.	...	9 0	100
		50 0	...	5 8	64

Measured without the bark.

Note.—The trees were Deodar, unless otherwise stated.

APPENDIX V.

Statement of the Geographical limits of some of the trees, shrubs, and useful plants in Kunawur, by J. L. STEWART, M. D.

U. Upper limit. U. R. Upper right bank limit. U. L. Upper left bank limit.
L. Lower „ L. R. Lower „ „ L. L. Lower „ „
C. Cultivated or planted.

BOTANICAL NAME.	KUNAWURAI NAME.	LIMITS.
Abies Smithiana ...	*Ryung* ...	U. R. Pangi. U. L. Rispa.
Acacia Julibrissin ...	*Shirin* ...	U. Above Wangtū
Acerculratum ...	*Trán* ...	
A sterculiaceum ...	*Lāúr* ...	
Alnus Nipalensis ...	*Nyū* ...	U. R. Spūi. U. L. Namgia.
Ampelopsis Himalayana ...		U. R. Urni.
Amygdalus Persica ...	*Rek* ...	U. R. Sungnam. U. L. Morung. Cult.
Arum Sp. ...		U. R. Pangi. U. L. Rakcham on the Buspa.
Arundinaria utilis ...	*Spyūg* ...	Above Panwi on the road to Shatūl Pass.
Betula Bhojputra ...	*Shāk, shāg* ...	Generally above 10,000 except where very arid.
Buxus sempervirens ...	*Pāprang* ...	Opposite Chergāon on the left bank of the Sutlej.
Capparis spinosa ...	*Bussar* ...	Wangtū to Urnī, along the Sutlej.
Cedrela toona (serrata) ...	*Khishing, Khanam* . .	U. L. Opposite Chergāon.
Cedrus Deodara .	*Kelmung, Kewate Gyam*	U. R. Hangarang Pass. U. L. Dabling and on Buspa below Rakcham
Celtis Caucasica ...	*Kur* ...	U. R. Jangi. U. L. Morung. C.
Cornus macrophylla ...	*Shtā, Shkā* ...	U. R. Urni. U. L. Jānī.
Corylus lacera ...	*Geh* ...	U. R. Pangi. U. L Poārī. C. & wild.
Daphne oleoides ...	*Zhīkuk* ...	L. Wangtū. U. Pangi.
Desmodium (argenteum) ...	*Mūss* ...	U. R. Sūngnam. U. L. Morung. Observed at Rārang.
Dioscorea deltoidea .	*Kāns, Gungru* .	Rakcham.
Elæagnus conferta ...	*Rinsot, rūl* ...	To Tibet. Cult.
Ephedra sp. ...	*Khanna, Khanda* ...	L. Urni, occasional to Tibet.
Eriophorum comosum ...	*mūjī, ūchī* ...	U. Chergāon.
Ficus caricoides ...	*kak, Kok* ...	U. L. Urnī.
Fraxinus Xanthoxyloides ...	*thūm* ...	U. R. Spūī. U. L. Namgia.
Hippophaë salicifolia ...	*sūls* ..	One or two below Wangtū. Urnī to Tibet. Cult.
Indigofera arborea ...	*kāstin* ...	U. R. Sungnam. U. L. Morung.
Juglans regia ..	*kā* ..	U. R Spūī. U. L. Namgia. Cult.
Juniperus communis ...	*lang shūr*	Purbnī.
J. excelsa ...	*shūr, Shurghu* ...	9,500' Werang Pass 10,000', and hill opposite Rispa on the right bank of the Teedong stream probably at a similar elevation.
J. squamosa ...	*theli*	Hārang Pass 10,000 feet.
Morus serrata ...	*an soū* ...	U. R. Jangī. U. L. Opposite Chergāon. Cult.
Myricaria sp. ...	*hombu*	L. Above Sangla, Rispa.
Olea (ferruginea) European ...	*wili* ...	U. (Rarang, Riba) Chergāon.

Statement of the Geographical limits of same of the trees, &c.,—continued.

Botanical Name.	Kunawuri Name.	Limits.
Paliurus aculeata ...	*thūm* ...	U. L. Jāni.
Parrotia Jacquemontiana ...	*shā* ...	Near Shoang only, 9,000 feet.
Pavia Indica ...	*pú* ...	U. R. Jangi. U. L. Purbani. Cult.
Phytolacca decandra ...	*matazor* ...	U. L. Opposite Chergāon.
Picea Webbiana ...	*spun, pun, Krok* ...	U. R. Lipi. U. L. Dabling.
Pinus excelsa ...	*līm* ...	U. R. Sùngnam. U. L. Namgia.
P. Gerardiana ...	*rī* ...	L. R. Chergáon. L. L. Jānī. U. R. Hangarang. U. L. Dabling.
P longifolia ...	*chīl* ...	U. Above Wangtū.
Pistacia integerrima ...	*Kakkrangche* ...	U. R. Urnī. U. L. Kīlba.
Populus alba ...	*māl* ...	L. R. Mirū. L. L. Poāri to Tibet. Cult.
P. ciliata ...	*krammal* ...	U. Rarang.
P. fastigiata ...	*do.* ...	U. R. Spūī: U. L. Dabling.
Prinsepia utilis ...	*bekling* ...	U. Urnī.
Prunus armeniaca ...	*chūī, burcha* ...	To Tibet.
P. Padus ...	*krūn* ...	U. On Buspa, above Sangha.
Pyrus variolosa ...	*kent, shegul* ...	To Urnī
Quercus dilatata ...	*marghang* ...	U. Jānī. C.
Q. Ilex ...	*bre* ...	L. Chergāon, Panwī. U. Telīng, Purbnī.
Q. incana ...	*bān* ...	U. L. Opposite Chergaon.
Q. semicarpifolia ...	*khursūī* ...	On Buspa above Sangla, not above Wangtū on Sutlej.
Rheum Moorcroftianum ...	*arts* ...	Above 10,000 feet. All over.
Rhododendron campanulatum	*sīmrung* ...	Hārang Pass.
Rhus Cotinus ...	*tung* ...	U. Above Wangtū.
R. semialata ...	*hulāshing, kashin* ...	U. Urnī.
R. acuminata ...	*hūrkú* ...	U. Wangtū.
Rhus sp. ...	*hulashing* ...	U. Sapnī.
Rosa Webbiana ...	*ring yāl* ...	L. R. Pangī.
Rubia cordifolia ...	*runaug* ...	
Rubia tinctorum ...	*backo* ...	Cultivated at Rispa.
Salix alba ...	*mudanū, shun* ...	L. Pangī.
Salix sp. ...	*shun* ...	
Staphylea Emodi ...	*kāghaniya* ...	U. Chergaon.
Syringa Emodi ...	*shāfar, rangchūl* ...	Rogī Raksham 10,000 feet.
Taxus baccata ...	*yamdal* ...	Above 9,000 feet.
Ulmus erosa ...	*shko* ...	L. Urnī. U. Rārang and Riba.
U. virgata ...	*maldúng* ...	U. R. Tangi. U. L. Riba.
Vitis vinifera ...	*lanang* fruit *dakhang*	L. Urni. Jani U. Spūī. Namgia
Xanthoxylon hostile ...	*timrū* ...	U. Wangtú.

APPENDIX VI.

Memo. of Heights from observations of boiling point by COL. R. MACLAGAN, 1847, *Heights calculated by Prinsep's Tables.*

	Feet above Sea.
Sutlej at confluence of the Machár between Kotgurh and Rampoor	2,706
Rampoor (town)	3,013
Wangtu (village)	5,133
Buspa, at the Sanga near confluence with the Sutlej	6,049
Pooari (village)	6,472
Riba (village)	8,449
Sutlej at confluence of Teedong	7,583
Dabling village	9,276
Namja „	9,305
Shipkee „	9,672
Lupcha Sanga on the Sutlej above Shipkee	8,384
Sanga on the Spiti at Shalkur	9,845
Jhula on the Spiti at Mane	10,929

APPENDIX No. VII.

Forest valuation Surveys, Jaonsar Bawur 1863.

No.	Date.	Name of Officers conducting the Survey.	Locality.	Deodar.					Area Surveyed.			Trees per Acre.		Remarks.
				First class above 6 ft.	Second class 4 ft. to 6 ft.	Third class 1½ ft. to 4 ft.	Fourth class small	Stumps	Length in ft.	Width in ft.	Area in acres.	First class.	Second class.	
1	June 9	Mr. Williams Mr. Melvill Dr. Brandis	South slope of Lokandi hill (Dunau District)	51	46	18	123	22	5000	300	34·43	0·90	1·84	Abies Smithiana 24 of the two first classes
2	„	„	Bodcher F Upper part (Dunau District)	31	42	376	621	91	2200	150	7·58	4·09	5·07	A Smithiana 48 of the two first classes
3	„	„	Bodcher F Lower part (Dunau District)	6	20	64	165	58	600	150	2·06	2·91	0·70	
4	„	Dr. Brandis	Molla hill N E side (Mashak District)	20	40	48	68	15	2200	200	10·10	1·98	3·96	
5	June 10	Mr Melvill Dr Brandis	Mashak Forest	106	242	262	259	75	6600	200	30·30	8·50	7·99	P excelsa 94 A Smithiana 56
6	„	„	„	53	80	35	15	70	2000	200	9·18	5·77	8·71	A Smithiana 19
7	„	„	„	10	27	58	22	14	200	150	0·69	14·50	39·13	P excelsa 23 A Smithiana 106
8	„	„	„	17	28	40	84	27	2700	150	9·30	1·83	3·01	Picea Webbiana 9

Forest on the Lokandi Spur.

Nos. 1—8. On the 8th June 1863, we determined to start upon a tour through the Deodar Forests on the Lokandi Spur, a westerly branch of the main range of water-shed on which Deoban is situated. The party consisted of Mr. Fleetwood Williams, Commissioner of the Meerut Division, Mr. Melville, Superintendent of Dehra Doon, and myself.

The road leads along a secondary ridge, which leaves the main range of water-shed between the Jumna and Tonse rivers north of Deoban, and takes first a westerly, and then a north-westerly direction. About 500 feet below the Deoban bungalow, and at an elevation of about 8,700 feet, we came to a field of barley not yet ripe. The fields of barley and wheat in thehigher parts of these hills are still green, but the people do not apprehend any failure of the crop on account of the approaching rains, as there is generally sufficient sunshine during June and July to ripen the crop. Our path led us through a Forest of Rai, with little Morunda *(Abies Smithiana* and *Picea Webbiana)* a great deal of Kurzoo *(Quercus semicarpifolia)* with fine tall stems. The rock is limestone, the strike of the strata almost due east and west, and the dip to the south. In the valley to the south we saw the villages of Jaddi and Mangul; near the latter, iron is smelted from good ore, and there is an abundance of wood for charcoal.

One Rai tree measured 8 feet 6 inches in girth and 95 feet in height to the point where the girth of the trunk is less than 3 feet. Another had been struck by lightning; the outer layers of the wood had separated from the inner. There was hardly any trace of fire, some of the branch stumps in the outer layers of the wood, were blackened as if burnt. Further on, the south side of the ridge was almost bare, whereas the north side was densely wooded. But stumps and stunted trees on the south side indicated that Forest had existed at some previous period. The villages, however, are numerous on this side, and this may possibly have led to the destruction of the forest. We found fields covered with young Bhatwa *(Chenopodium)* which is sown in March, and ripens in October.

We pitched our tents above the village of Raju, below the Lokandi Pagoda. Near our camp lay a large number of Deodar planks, brought from the Forest on the north side of the ridge. Most of these were 7 to 10 feet long, 1 to 2 inches thick, and of various breadth. They had been cut by the villagers, who sell at the rate of 19 feet or 10 cubits in width, or about 150 square feet for one rupee. The purchasers come from the southern part of the district and from the villages near the Amlawah, Tonse and Jumna Rivers, where no Deodar grows. In the afternoon, I ascended the limestone peak on which stands the Lokandi Pagoda, a square wooden temple, surrounded by a low stone wall. Near it are terraces where the villagers assemble on their annual feast days. On the limestone rocks there is much fine Leauri *(Cupressus toruloea)* and to the west and north much Deodar. The view from this point, the highest on the spur, is beautifully varied with dense forests in many places. To the north-west the spur terminates in the Moila Hill with picturesque limestone rocks and gently sloping meadows. On my return to camp I measured three Deodar trees with stems fit for timber 60 feet long and girths of 7 feet 8 inches, 8 feet and 13 feet 6 inches. One tree, with a girth of 6 feet 10 inches, and a stem fit for timber of 55 feet, had been felled. The stump showed 78 rings on a radius of 12¾ inches, of which 3 inches were sapwood; the largest cypress was 7 feet 6 inches in girth and 80 feet high.

9th June.—Started to go round the Lokandi and Moila Hill, from south to north. Upon the south slope, there is a quantity of Deodar scattered between the fields; here the trees noted in Valuation Survey No. 1, were counted. Many of the Deodars had their side branches lopped off, nearly the entire length of the stem, probably to be used as litter for cattle. Crossing a side spur running in a south-west direction, we entered a splendid Forest named Bodehēr, consisting mainly of Deodar, which here attains a large size upon a clay slate soil. We measured a tree which had been felled; the stump 6 feet 7 inches in girth; the entire length of the stem up to an end girth of 3 feet being 82 feet. The age of this tree was 71 years. The following trees were also measured:—

Girth 7′ length 75′ to an end girth of 3′.
„ 6′ 9″ „ 85′ „ „
„ 7′ 2″ „ 115′ „ „

The rate of growth appears from the data entered in No. 36 of Appendix III. Deodar in this Forest forms one inch of wood (radius) in from 5 to 9 years. The stem of these trees does not taper much as will appear from the following statement:—

Tree.	Girth at butt.	Upper girth.	If girth at butt 100″ proportionate upper girth.
1	4′ 5″	1′ 9″ measured at 58′	39″
2	6′ 10″	4′ 0½″ ditto „ 48′	59″
3	6′ 10″	3′ 1″ ditto „ 68′	45″

The surveys of this Forest are entered under Nos. 2 and 3. The figures there entered, 4·09 and 2·91 first class trees per acre, do not convey a sufficiently favourable idea of the contents of the forest. In some parts the trees stood much closer. The area of the forest probably extends over several hundred acres.

The proximity to the Tonse renders this Forest peculiarly valuable. In a straight line the distance is only 4½ miles, and by the road, which was said to follow the course of a valley, it cannot be more than 10. A large quantity of timber is being cut, and the people say that it is all consumed for house-building in the neighbouring hill districts. The usual scantlings cut are from 20 to 30 feet long and 5 inches by 6 inches or less, and planks for walls and roofs from 4 feet to 7 feet long and 1 inch to 1½ inches thick. At the lower end of the Forest we saw a stack containing upwards of 660 planks, 10 feet to 12 feet long, 12 inches to 14 inches wide, and 3 inches to 4 inches thick. These had been cut on account of Government for a bridge over the Tonse, and had been lying there for several years, but had not apparently suffered by exposure.

Near these planks we were surprised to find five stumps of trees recently felled, 7 feet in girth. A few planks had been taken off, but the greater part of the trunks had been burnt apparently a short time ago. The people asserted that the trees had been destroyed by jungle fires, but as there was no sign of recent fire round about, this cannot have been the case. The wood must either have been used for the manufacture of charcoal, or the place was cleared for temporary cultivation, and the timber burnt. We observed in the course of the day many similar instances of destruction. In some cases, it appeared that the standing trees had been ignited, and we found the burnt remains of large branches which had evidently been heaped up round the trunk. Trees are commonly thus burnt in the hills, to get rid of them for the purpose of cultivation, but these trees were often in the midst of the forest where no cultivation was likely to be attempted; possibly they are burnt to obtain charcoal with little trouble

From the Bodehēr Forest we turned our steps to the Moila Hill which is a north-west prolongation of the Lokandi Spur. We had a good view of the Tonse in several places, as it flows round the base. The Moila Hill sends out three spurs; one runs to the west towards Aswi. On the south side of this spur, and all along the flank of the hill, there is a great deal of Deodar, not forming continuous tracts like Bodehēr, but in patches intermixed with Rai. The path leads through this tract, but as we were obliged to proceed rapidly, no survey was taken. Between the west and north-west spurs towards the villages of Kunwa and Pingwa, there is little Deodar. The slope is in many parts precipitous, being formed of almost perpendicular limestone rocks. Where there is room, Leauri *(Cupressus torulosa)* and Rai *(A. Smithiana)* are abundant. I walked nearly round the Moila Hill, and a considerable distance down the north-west spur, but found only a few scattered Deodar trees. In the angle between this and the third spur, tending towards north, north-east, is the village of Rahan, below a limestone precipice which here borders the Moila Hill. Far down in the valley there is a little Deodar, but near the top all is *Abies* and *Cupressus*. The third great Deodar locality occurs in the bend between this northern spur and a large spur running from the Lokandi Pagoda to the north-east, towards the junction of the Benargad and Chiligar. In this valley the village of Mashak is situated. The main portion of the Moila Hill is limestone. The strike of the strata is from north-west to south-east, and the dip towards the south-west. In accordance with this formation of the strata, the south-west slope is gradual as on the Lokandi Hill, and the other sides are precipitous. It has already been mentioned that clay-slate is found in the Bodehēr Forest. It also occurs near the village of Mashak.

Wherever Deodar was found on the Moila Hill, there were the marks of cutting, and a plank 25½ feet long 10 inches by 1½ inches was seen near the top. On my way down to Mashak village, survey No. 4 was taken. Deodar is here scattered over the steep and often precipitous slope of the hill; the result was two and four trees per acre of the 1st and 2nd classes. The growth of the trees, however, is good. One tree, which had been struck by lightning, was 11 feet 9 inches in girth and 70 feet long up to 3 feet end girth.

We found our tents pitched on a terraced field near the village of Mashak, surrounded by Apricot and Peach trees. The village bears every mark of being in the midst of Deodar Forest, the houses are built with magnificent pieces of this wood. We measured several planks 37 inches wide, 4 inches thick, and 8 feet long. The aggregate width of three planks, which served as the flooring of a terrace in front of a house, was 15 feet 4 inches which gives an average width of 5 feet 1 inch. The length of these was 16 feet 6 inches. The enclosure round the open square paved with large flags of slate, where the elders of the village assemble, was formed by Deodar beams 28 feet long 12 inches thick and 15 inches wide. The houses in Mashak are neat, the lower part is of stone, with beams between to strengthen the walls. These beams are painted with ochre which contrasts well with the white plaster of the walls, and the light brown color of the wooden superstructure. The lower portion just described serves as a store-house for grain, and is closed by massive Deodar doors with large well carved door frames. The upper story stretches out on all sides 3 or 4 feet beyond the understructure, and is supported by trusses and pillars neatly carved. It is entirely built of wide Deodar planks, some sawn, others split, and all from 2 to 4 inches thick. The roof is a simple gable, projecting beyond the upper story, covered with thick split Deodar planks or shingles.

10th June.—We took a path which led round the semi-circular valley enclosed by the Moila and Lokandi Hills, and a spur running northward from the latter hill, then crossed this spur and following the head waters of a tributary of the Benargad, which falls into that stream above its junction with the Chiligar, gained the main ridge above Jaddi village and returned to Deoban by the road of the 8th.

After leaving the clay-slate and quartzose rocks near Mashak, the route lay entirely over limestone. Deodar was plentiful on the first portion of the march, but disappeared when we began to ascend the main ridge. There is Deodar on the north face of this ridge but lower down, between the spur mentioned above and that by which the Simla road ascends to Deoban. This forest is called Kandari, and furnished the timber used in the construction of the Deoban Bungalow. In survey No. 7, the trees counted on a small space

200 feet × 150 feet accurately measured, are noted. Ten trees of the first, and 27 of the second class were counted. Some of these were not Deodar, but the object was merely to ascertain the amount of timber standing on that area. The first class trees measured 100, the second class 25 cubic feet of marketable timber. This gives per acre 2,460 cubic feet. The average age of the first class trees was 70 years, so that the annual production of marketable timber has only been 35 cubic feet. The longitudinal surveys (5, 6, 8,) give a less favourable result as they include blank spaces, and localities producing other trees than Deodar. Besides *Picea Webbiana* and *Abies Smithiana*, there was a large quantity of Cheel (*Pinus excelsa*), Raj and Morunda have a dark, Cheel and Deodar a light green foliage, but the general appearance of the Pine at a distance is different, the branches not spreading horizontally as those of the Cedar do. Of other trees there were three kinds of Oak, Ban (*Quercus incana*) and Moru (*Quercus dilatata*) below, and Kurzoo (*Quercus Semicarpifolia*) above, and associated with the grey Oak, large numbers of Andromeda, forming trees of 4 feet in girth.

Rate of growth.—Great extremes were observed. One tree (no 3 in Register) was found on a limestone slope with south-east aspect, which had been felled many years ago. The measurements of this tree were as follows :—

Girth	...	...	...	17′
Length of stem		...	...	170′
Age	...	...	...	143 years

The average time required to form an inch of wood (radius) 4·8 years.

This remarkable growth surpasses all the trees yet measured. As some of the rings were indistinct upon the charred surface of the stump, the rings were counted on three distinct radii, to guard against any mistake ; the results were—

r′	...	...	...	140 rings
r″	...	...	...	159 „
r‴	...	...	...	130 „

This tree attained a girth of 4 feet 6 inches with 38, and a girth of 6 feet with 50 years

Two trees on a slope exposed to the west, and also on limestone (Nos. 1 and 2) were 4 feet 2 inches and 4 feet 4 inches in girth, and had required 98 and 64 years to attain these dimensions. Another Deodar (No. 4) was measured which had grown to a girth of 6 feet 2 inches in 47 years, another instance of rapid growth. In this case the aspect was northerly. A Cheel stump (No. 5) 7 feet in girth shewed 83 rings.

Near the large tree described (No. 3), four fine trees were seen on a small space 45 feet × 35 feet = 1,575 square feet. This was the space covered by their branches. One of them divides above the ground into two large boles, The measurements of these five stems are as follows :—girth 6 feet 10 inches, 6 feet 8 inches, 6 feet, 5 feet 11 inches, 5 feet 10 inches. The height is 105 feet to the top of the 6 feet 8 inches tree, and 90 feet for the others. If calculated on the acre, this would give 140 first and second class trees per acre. It may therefore not be impossible to produce with good management in similar localities 100 first and second class Deodars per acre, giving upwards of 7,000 cubic feet of marketable Deodar timber, and an annual average yield per acre of 100 cubic feet.

Close to these fine specimens of well grown trees, there were the traces of reckless waste of valuable timber to obtain a trifling return. On a space of about half an acre, prepared for a species of *Chenopodium*, sown at the commencement of the rains and reaped about October there were eighteen first and second class Deodar trees standing, but killed by fire, and twenty-six stumps of trees felled to make room for this temporary cultivation. The trees, if not felled, are destroyed by lopping the whole of the branches, heaping them round the foot of the tree and setting fire to them. This kind of cultivation, which is similar to Toungya in Burmah, Dhya in Central India, and Coomree in Madras, is called Khil in these hills. The land is, deserted after one crop is taken. On the slope of the hill, where the village of Mashak is situated, we counted on an area 1,000 yards long and 500 broad, ninety Deodar trees destroyed in this manner.

A little further on, we measured a remarkable tree overhanging a precipice, and divided a few feet above the ground into five boles, each 5 feet in girth, the joint girth of the whole group being 24 feet. One of these had been felled, the height of the main stem of this compound tree was 121 feet. The timber yield of these forests, to judge from the large number of stumps counted, has been very considerable. I observed several sawpits and a large number of scantling recently cut, placed near the roadside ready for removal The following timbers were noted near the road —Twelve round pieces prepared from young trees, from 25 feet to 32 feet long, girth 1 foot 10 inches to 2 feet. Forty-four rafters 20 feet long and 6 inches × 6 inches. Fifty planks 8 feet long from 12 inches to 30 inches wide and 1½ inches to 3 inches thick. Sixty planks 5 feet long and 1½ inches thick. It was stated that all this timber had been cut by people from Naraya in the Amlawa valley, who come up every year to fetch wood for their houses, and that they paid to the head man at Mashak village a duty of from 4 to 5 annas per tree. All this timber is carried away on men's shoulders.

No	Date	Name of Officers conducting the Survey.	Locality	Deodar					Area Surveyed.			Trees per acre.		Remarks
				First class above 6 ft	Second class 4½ to 6 ft	Third class 1½ to 4½ ft	Fourth class small	Stumps	Length in ft	Width in ft	Area in acres	First class	Second class	
9	June 11	Dr Brandis	Along the main range N of Deoband (Doar Monar and Bislar)	14	47	14	35	15	16500	300	127·41	0·11	0·37	
10	"	"	Above Khattowa village (sacred grove, planted) (Bislar)	20	12	25	22	...	200	100	0·46	43·48	26·09	Slope 32
11	"	"	From the main range to Khattowa village (Bislar)	10	36	23	14	5	11700	300	80·57	0·12	0·45	
12	June 12	"	From Khattowa village to main range (Bislar)	48	178	21	55	23	4800	300	33·05	1·45	5·38	
13	"	"	Along the main range to Mondehoo (Kolloo and Bislar)	148	63	80	898	34	5200	150	17·91	8·26	3·52	
14	"	"	Mondehoo to Foot of Karama or Daghur Peak (Bondar Lokhar)	66	81	38	610	91	5000	200	22·95	2·87	3·52	Deodars dry 2

FORESTS ALONG THE MAIN RANGE FROM DEOBAN TO THE KARAMA PEAK.

Nos. 9 to 14. On the 11th June I started in the afternoon to explore the forests along the main range between the rivers Tonse and Jumna. After leaving Deoban, the range takes an east, north-east direction, and the road leads chiefly along the south-east flank, keeping near the line of water-shed. About a mile north of Deoban, Deodar commences, it is, however, scattered; on a distance of 3½ miles only 14 trees of the first and 47 trees of the second class were noted, (Survey No. 9). To the right are the head-water of the Kutno stream, and to the left those of the Benargad. As the weather was threatening, we turned off to the right to a tributary of the Kutno river, encamping at a village called Khattowa. On the road to the village, Survey No. 11 was taken. Above the village is a temple forest containing a large quantity of Deodar on a slope of 32°. On an area 200 feet × 100 feet or 0·46 of an acre, 20 first, and 12 second class trees were found (Survey No. 10). The average cubic contents of a first class tree, taking 50 feet as the length of the stem available for timber was found to be 72 cubic feet, that of a second class tree 18, and the average annual increase per acre would be 42·9 cubic feet.

On the 12th June, we again ascended the main range, the road leads first through a moist ravine with deciduous trees, which opens out higher up where there is a good forest of Deodar on limestone rock, the strike running north-west, and the dip being towards the north-east. (Here survey No. 12 was taken). On both sides of the main range very fine forest was found, extending to the foot of the Karāma or Daghur Peak. On the left we looked down on the forests near the source of the Benargad and the Chiligar, and to the right on those near the Riknargad. On a length of about two miles along the main range, we counted 214 first class trees. (The detail is given in surveys 13 and 14). *Picea Webbiana, Quercus semicarpifolia* and *Quercus dilatata* were the principal trees associated with Deodar. Rai, *A. Smithiana* was scarce.

No	Date	Name of Officer conducting the Survey	Locality	Deodar					Area Surveyed.			Trees per Acre.		Remarks
				First class above 6 ft	Second class 4½ to 6 ft	Third class 1½ to 4½ ft	Fourth class, small	Stumps	Length in ft.	Width in ft.	Area in acres	First class	Second class	
15	June 12	Dr Brandis	Foot of Karama Peak to range above the Tutwa Forests		...	..	100	7	8500	200	39·07			Deodar dry 1
16	"	"	Tutwa Forest (Bawur)	201	185	207	270	75	7000	150	24·10	1·083	7·67	Deodar dry 16

FORESTS NORTH OF THE KARAMA PEAK.

Nos. 15 and 16. From the top of the Karāma Peak we had a fine view of the Deodar localities in this part of Jaonsar Bawur. There are extensive forests at the foot of the peak to the north and north-east, on both sides of the spur which forms the water-shed between the Chiligar and Dharagad, and on the west flank of the main range.

After descending from this peak, little Deodar was seen, for about a mile and half, until we reached the Tutwa Forest (Survey No. 15.) The ridge above the Deodar producing localities is covered with beautiful grassy glades in which stand some splendid specimens of the undermentioned forest trees, attaining the dimensions noted :—

	Girth.	Height.
Abies Smithiana	15′	150′
Picea Webbiana	15′	130′
Acer	13′	...
Quercus semecarpifolia	13′	...
„ dilatata	12′	150′
Prunus Padus	6′	...
Juglans regia .. .	17′	100′

A few hundred yards below, the Deodar Forest begins. Here the trees are of splendid size, of two trees here measured, both 11 feet in girth, one was 115 feet, the other 135 feet high to the top. The rock appears to be limestone with a deep layer of vegetable mould on it. The rate of growth was good, though the slope was steep. The details are shown in No. 39 of Appendix III. The average age of trees 6 feet in girth was found to vary from 70 to 98 years. The particulars of the survey made through the Tutwa Forest, are entered in No. 16. With Deodar were associated immense Rai trees; one measured 18 feet 5 inches in girth, Birch up to 6 feet in girth. Lower down near the foot of the hill was a dense forest of *Alnus, Rhododendron, Quercus incana, Populus ciliata,* and a variety of other trees. In this forest were old stumps of Deodar and half-decayed logs lying on the ground. Apparently the Deodar formerly extended further down, and other trees have subsequently occupied the ground.

Along the road from Deohan we had met many men carrying planks and other scantling from the Tutwa Forest which is resorted to for timber to a great extent by the inhabitants of the lower and treeless parts of the district. In the forest we found 75 stumps of trees recently cut and many felled trees, utilized only to a small extent The timber is here split, not sawn, and the waste is great.

Twenty-four acres of the Tutwa Forest were surveyed, and the result was an average of 11 first class trees per acre. From the data furnished by my guide, the area of the Tutwa Deodar Forest may be estimated at three square miles. It occupies a considerable portion of the hills, south of the head waters of the Dharagad.

After crossing a small stream, the southernmost feeder of the Dharagad, we came upon a dry open slope with scattered trees of *Pinus longifolia,* here called Surul, of very large size; the soil was a micaceous schist. After a march of several hours, during which we crossed successively several feeders of the Dharagad, we reached the village of Chejal long after dark, where we encamped.

On the 13th we went from Chejal along the north side of the spur, running from the main range in a north-westerly direction towards the junction of the Pabur and Tonse rivers

No	Date	Name of Officer conducting the Survey	Locality	Deodar					Area Surveyed			Trees per acre		Remarks
				First class above 6 ft.	Second class, 4½ ft to 6 ft.	Third class, 1½ ft to 4½ ft.	Fourth class, small	Stumps	Length in ft.	Width in ft.	Area in acres.	First class	Second class	
17	June 18	Dr Brandis	Chilu (Bawur) Jungle	185	380	468	421	1040	5100	180	21·07	8 78	17·08	Deodar killed 1898
18	„	Dr. Brandis	Chilara (Bawur) Jungle	15	33	48	56	11	1400	180	5·78	2 60	6 57	
19	„	„	„	11	13	37	7	23	100	150	0·34	32·35	38·24	Deodar dead.
20	„	„	„	143	123	166	1,313	123	2200	180	9·29	1 513	13 53	

FORESTS ON THE NORTH FLANK OF THE CHEJAL SPUR.

Nos. 17 *to* 20.—Chejal village stands high on a south projection of this spur, and has a splendid view of the vast mountain bay drained by the Dharagad in which some of the finest Deodar Forests of Jaonsar Bawur are situated. The road from Chejal to Bastil village on the Tonse led for about one mile through what must formerly have been an excellent Deodar Forest. A large portion has been destroyed for temporary (khil) cultivation. No less than 1,040 stumps and 1,898 standing trees killed by fire, were counted Notwithstanding this destruction, the forest still contained, when examined, upwards of nine first class trees per acre on an average, with an abundance of saplings. The trees associated with Deodar were Rai, Ban, and Moru.

After leaving the forest, we passed through a jungle of Andromeda and Rhododendron. Further west the spur divides into several branches. On the northern branch, near the junction of the Pabur and Tonse, the village of Koti is situated. Not far from this is a Deodar Forest said to cover about 15 acres in which 100 trees have been cut for the bridge over the Tonse river, and 50 for a temple in the vicinity. The forest of Koti and Bastil are alluded to in Dr. Cleghorn's Punjab Forest Report, 1864, page 5. This forest near Koti, I only saw at a distance as my road led down another spur to the village of Bastil. On the northern slope of this spur is the Chilara Forest, where an area of 150 feet by 100 feet was measured, and 11 first class and 13 second class trees were found, which gives the average number per acre of the trees of these two classes as follows :—

1st Class trees 32
2nd „ „ 38

The trees in this small forest are of good size and satisfactory growth. A tree with a girth of 11 feet 7 inches showed only 98 rings. *Pinus excelsa* is the only tree here mingled with Deodar. Near Bastil is a large quantity of *Olea ferruginea* (Kau) and lower down near the Tonse, Sandun (*Ooieinia dalbergioides*) Semul (*Bombax Malabaricum*) and *Acacia Julibrissin* were found.

A considerable number of planks and other scantling of Deodar were met in transit on the road. Since we left Deoban on the 11th, we have seen altogether 203 planks and small beams (kurries). This evening we encamped at Kando, and on the 14th we returned to Deoban by the Simla and Mussoorie road. As far as Bandrouli much *Pinus longifolia* is scattered on the slopes of the hills. A considerable quantity was cut a few years ago by Messrs. Scott and Wilson of Mussoorie, for Railway sleepers.

GENERAL REMARKS ON THE TAONSAR BAWUR FORESTS.

The data collected are not sufficient to justify any but an uncertain estimate of the Deodar resources of these hills. Altogether 485 acres were surveyed, and on this area 1,195 first, and 1,662 second class trees were noted. If the statements of the natives of the district regarding the extent of the Deodar localities are correct, the forests would contain not less, than 40,000 Deodar trees.

The average age of a first class tree 6 feet in girth in these forests may, on the ground of the data available, be assumed at 71 years, and that of a second class tree 4 feet 6 inches in girth, at 55 years. If these data are correct, 16 years will suffice for second class trees to attain first class size. The number of second class trees is about equal to that of the first class. If we, therefore, clear away all first class trees in the space of 20 years, or at the rate of 2,000 trees per annum, this quantity will, if the above data are correct, be within the amount annually produced in the Deodar Forests of Jaonsar Bawur. Great care should, however, be taken, first to ascertain by a series of detailed valuation surveys, the capabilities of the different divisions of the forests, and on the ground of these valuation surveys, a regular plan for working the forests should be prepared and strictly followed. The transport of the timber to a place of sale without undue expense is the great difficulty, as all the more valuable forests are situated at a considerable distance from the river. If this difficulty can be overcome, and if the unrestricted and wasteful cutting of Deodar by the inhabitants and by parties from the lower parts of the district can be prevented, these forests will prove of great importance on account of the good size and the rapid growth of the timber produced in them.